TRENDS IN EDUCATION

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Team Teaching Experiment
Practical Biology Code
Dainton and the Schools
The Place of History
Social Studies
Drama Survey
Continuity of Care
School and College
Educating Technicians

JULY 1968

Department of Education
and Science

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The right to education is enshrined in the Universal Declaration of Human Rights—yet the world still contains a thousand million illiterates or semi-literates, and this figure includes two out of every five adults. In the majority of European countries over 80 per cent of the children of school age go to school, but in some African countries enrolment is still no more than 5 per cent.

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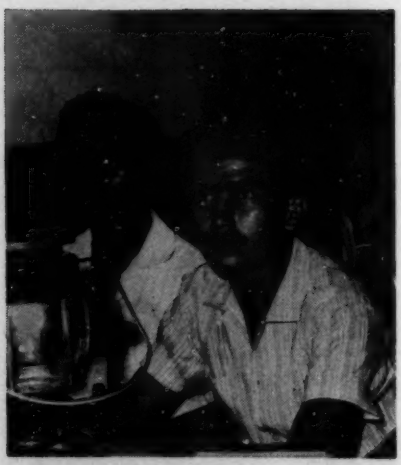

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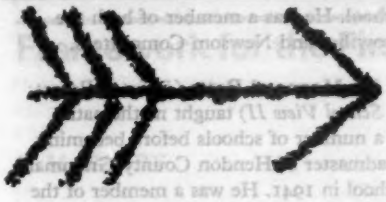

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The Editorial Advisory Board of Trends in Education *consists of senior officers of the Department and senior members of the Inspectorate. The Chief Information Officer is general editor, supported by an executive editor (Martyn Clémans) and an associate editor (David Hopkinson, HMI). Correspondence should be addressed to the executive editor.*

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The opinions expressed in Trends in Education *are the writers' own. They may not necessarily be in accordance with the views of the Department of Education and Science*

The transition from primary to secondary school confronts pupils with a very different style of curriculum. One comprehensive school is experimenting with a team teaching project for first forms to make the new work more meaningful.

Framework for the First Form

J. M. PARRY

Team teaching has been in operation in this comprehensive school for the past three years. We applied it first to an outward-looking course for over a hundred fourth-year leaver pupils, as well as to a liberal studies course in the sixth form. A further and more radical extension of team teaching is now in its second year of operation with our first forms, a development which arose, not because it was desired to extend the field of operation of team teaching, but because an educational need was felt to exist which could only be solved by this approach.

The basic concern was with the curious discontinuity produced in a child's life in the transition from the primary to the secondary school. This involves far more than a change of building and in general an adjustment to an increased size of school; for it marks the end of a period in which, in the more enlightened primary school, the pupil has been encouraged to investigate the nature of the surrounding world mainly under the guidance of one teacher. From the moment of entry into the secondary school, knowledge becomes fragmented into several subject disiplines, each taught by a different teacher, studied largely in isolation from one another, and with the prospect of distant public examinations exerting a baneful influence upon any thoughts of a more enlightened curriculum. At first, the pupil displays interest in the variety of information on offer and the constant change of scene as compared with a primary school situation but, as time passes, for many pupils a decline of interest sets in which is not by any means confined to the less able pupils. Some subject preferences develop, often where the pupil finds the teaching congenial and, where it is not, other subjects become increasingly rejected regardless of their basic importance. The minority of pupils who reach the sixth form often do so with deep-rooted prejudices towards whole fields of knowledge and I believe it to be a matter for deep concern, not only on grounds of economic progress or national security, that so many of our pupils develop either an antipathy or disinterest in the field of science during their secondary school career.

Admittedly, the new Nuffield science programmes stem from recognition of this situation and they make stimulating and often radical efforts to rethink the whole school approach to this field of enquiry. But it is arguable that the fundamental malaise in the whole secondary programme lies deeper than the infelicities of any particular subject; it may arise because the pupils increasingly fail to see the relevance of much they are taught. Implicit in the curriculum of our secondary

schools is the assumption that, for each pupil, out of the study of many subject disciplines there will gradually emerge a coherent unified view of human knowledge which will allow us to describe the pupil as developing into an 'educated' or 'cultured' human being. But I imagine that few of us can rest content that this process takes place for many of those in our care! In fact, it requires an able and unusually independent minded pupil to achieve this synthesis and this is done despite rather than because of early subject specialisation. The proliferation of courses for senior pupils which appears to attempt to make good the lack of coherence and relevance of specialist subject topics of the earlier years bears witness to this state of affairs—whether they be designed for fourth year leavers or as a liberal or social studies course in the sixth form.

To deal with this situation, I believe that a young person needs to be constantly helped to achieve a perspectival grasp of knowledge so as to be able to relate the continuous influx of fresh facts to the view already obtained. This view will broaden and deepen but it should always exist and it should be our concern to devise a curriculum which will give each pupil the maximum opportunity to achieve this state. If this synoptic approach to knowledge is to be encouraged in the secondary school, I believe it must start when the pupils arrive, since their backgrounds are often very diverse. This is true of our comprehensive school where we have an eight-form entry of pupils who come from a large number of primary schools; the pupils' collective background knowledge is wide but subject to considerable individual variations.

Accordingly, to deal with the various elements mentioned above which are involved in the transition from primary to secondary school with the difficulties entailed, a programme has been devised which involves three closely interrelated developments.

(a) The extension of academic and pastoral care by first form teachers.
(b) The integration of some subjects.
(c) A team teaching approach to the integrated subjects.

These developments entail certain consequences. Thus, to extend the academic and pastoral care of the first-year form teachers means that these teachers need to spend more time with their forms. This, in turn, means that unless there is a disproportionate amount of time allotted to the form teacher's own subject, the form teachers must take their forms for more than one subject. If they are to take more than one subject then, bearing in mind the goal of a more synoptic view of knowledge for each pupil, it is necessary to decide what subjects the form teacher should take so as to effect this synthesis. In our case, the subjects chosen are history, geography and science. This combination came about because the geography and history departments had an encouraging record of co-operation in the team teaching approach previously mentioned which was adopted for the modern studies course for the fourth year leaver forms: they had produced an integrated syllabus covering a wide range of ideas designed to give these pupils a perspectival knowledge and it was this type of approach which was now needed in the first year. The inclusion of science in the programme was inescapable in view of the conviction expressed earlier that it is impossible to arrive at a worthwhile perspective of knowledge in its absence. Finally, since the range of ideas presented in these three subjects is wide, a team teaching approach is applied since it is

felt that if the form teachers operated in isolation, they would find the task too arduous. Moreover it is intended that specialist skills shall be applied as far as possible.

Selection, Comparison and Interpretation

The attempt to provide the pupil with some perspective of the field of knowledge before he or she becomes involved in increasingly specialist studies requires us to ask the most searching questions about what are the really important ideas which man has acquired about his environment and then to make a careful selection, comparison and interpretation of these ideas so as to convey them to pupils in this age group in a way which does not obscure the wood for the trees. Our first attempt to do this resulted in a 'history of ideas' curriculum which had an excessively chronological emphasis but, armed with this experience, we have now in the second year substituted for a multiplicity of ideas just three major topics, one to each term. They are:

First Term. Man in his Environment.

(a) Location in the Universe; ideas about the universe, galaxies, solar system, planets.

(b) Nature and Location of our Planet; its probable formation and geological history.

(c) Appearance of Life on Earth and the Evolution of Man—this includes a first mention of reproduction, including human reproduction.

Second Term. Law and Order.

(a) Law and Order in the Physical World—laboratory-based investigations leading to appreciation of basic laws and structures of matter; the key lessons are then used to give a wider picture of more general Laws which hold in the Universe.

(b) Law and Order in Human Society—caveman to the UN.

Third Term. Man Controls and Alters his Environment.

(a) Historical survey of major achievements of earlier civilisations.

(b) The Great Revolutions—Agrarian, Industrial and Scientific.

Each of the eight first-year forms is allocated twelve periods in the forty period timetable to carry out this programme which has come to be known as 'core studies'. All forms are timetabled to meet in the hall for the latter half of Thursday morning for the key lesson. This is an outline of some item in the curriculum given by one of the form teachers who has a specialist competency in it. The audience consists of *all* the first year forms (including the remedial form) and their form teachers and the lesson is illustrated by the use of visual aids of all kinds. Some notes are taken by both teachers and pupils during this key lesson. Certain points need emphasis in connection with the key lesson.

(a) It is felt to be most worthwhile to have *all* first-year pupils present since we are attempting to present fundamental ideas which are of importance to all pupils.

(b) With such a range of pupil ability, the key lesson is primarily designed to arouse curiosity and a desire to find out more about the topic—it should only introduce ideas and suggest follow up work not delve into detail. It is a histrionic performance, given by an enthusiastic specialist to a young audience who have no history of failure or examinational phobia towards the topic. The pupils are encouraged to participate by frequent question-

ing from the speaker which elicits previous knowledge possessed by pupils on the topic; references are made to previous work and to other key lessons.
The key lesson may last from 25 to 60 minutes depending on the topic, the speaker, but, above all, on audience reaction. For new teachers, the experience is illuminating; they see experienced able teachers exploiting a wide variety of teaching techniques in presenting a key lesson on which more than usual care and attention have been lavished.

Four periods are available to each form for laboratory work and the remaining periods are spent in the form room where the form teacher encourages work at the appropriate level to the form. We are fortunate in having a good rural studies block which houses a 'small animal' section and this has made possible a direct study by pupils of various aspects of living things involved in the 'core studies' programme. The form has access to the form room at lunch breaks and they frequently make use of this time to carry on with project work. The team of eight form teachers meet regularly twice a week to discuss progress made with the ideas presented in the previous key lesson and to discuss the ideas to be put forward in the next key lessons. Teachers' notes are provided by the teacher giving the key lesson and, where necessary, apparatus and visual aids are demonstrated. We are also fortunate in having the services of three laboratory technicians and their assistance is valuable to members of the team whose science background is minimal. In this connection it is worth stressing that the members of the team are drawn from the departments whose subjects have been integrated in this 'core studies' work, namely history, geography and science, and accordingly the range of ideas presented transcends the subject specialisms of each teacher. Far from this being a drawback, it serves to emphasise the investigational approach in the classroom; the teacher assists and guides the activities, becomes involved in discussion on the work with other members of the team and obtains guidance and assistance on specific topics. A modicum of unfamiliarity on the part of the teacher with certain topics generates sympathy with, and understanding of the difficulties of the pupils and this generosity of approach is maintained when presenting more familiar items within the teacher's subject competence.

The extension of the influence of the form teacher has occurred since the 'core studies' extends over the twelve periods. As a result, our first year pupils receive more intimate academic and pastoral care than ever before. This has produced a lively involvement in their course and visitors remark on the readiness with which the pupils discuss their work. A high level of classroom activity is maintained, models and charts are produced in abundance and there is some resemblance to the better primary school practice in this sphere. There has been some valuable linking of work with other departments such as art and craft and some departments have expressed a wish to become partially involved in this 'history of ideas' syllabus.

Discarding Traditional Examinations

An interesting question arose concerning the type of assessment if any, which could be applied to this work at the end of the year and, eventually it was agreed to discard the traditional pattern of examinations.

Instead, each pupil was given the task of compiling a book of answers to a large number of open ended questions based on the work covered. Question paper and booklet were handed out at the beginning of each lesson and collected back at the end but, during the period, free access was allowed to class reference books and personal notebooks, charts and files. The assessment period lasted for the whole of the week's allotment of 'core studies' time, that is, twelve periods. For the purpose of internal comparison, some course grading of answer books was made but no grade or mark was put on the booklets, although comments were, since the object of the course was to encourage effort and interest not to stratify achievement. The answer books were subsequently on display at the first year parents evening at the end of term.

In their second year at school, pupils go on to study in separate subject disciplines (mainly because few teachers are polymaths of sufficient degree) for history, geography and science with specialist subject teachers but it is worth emphasising that the heads of departments involved are most concerned to relate the second year's work to the first year approach. It is thus possible to give relavance to the particular topics pursued in successive years by setting them against the broad background of work covered in the first year and so preserve and enhance the pupil's perspective in later secondary school work. I hope that, arising out of our efforts to give to our new pupils an introductory synoptic view of a considerable part of the field of knowledge they will later study more intensively, we shall be able to preserve their desire to go on learning. And, although in the upper reaches of the school formal examination pressures become more important for many of the pupils, I believe that the freedom and scope afforded by the new CSE examination will help us to produce pupils who are not disenchanted with study but, on the contrary, are keen to pursue their courses right to the end of their time at school. The extent to which this is, at present, an unrealised aim is a measure of how much still remains to be done in the field of curricula reform.

Finally, it is worth stressing the contribution which team teaching on this scale can make towards teaching technique among the school staff. Undoubtedly, one of my more pleasant experiences at this school is to attend the twice weekly meetings of the 'core subjects' team when the work in progress is under discussion. The obvious concern for students, progress and teaching approach which are experienced in an atmosphere of warm good humour provides a striking example of the removal of the traditional teacher-classroom isolation. Where possible, the first year form teachers move on at the end of the year to take their form in second year work in their own subject but some of them will also take a first year form again. Those who do not are replaced by newcomers to the team and so, despite staff changes, it is expected that the number of members of staff experienced in this technique will increase. The aim is to have a team in which experienced teachers and newcomers are mixed and I believe that this arrangement is of special value in helping the new teachers quickly to become effective members of the staff.

Much has been written about the work done by the comprehensive school and the FE College, in an atmosphere of competition. The theme of this article is that there is a large field of work that can be undertaken when there is co-operation between them.

School and College Co-operation

W. G. SKINNER

I would emphasise at the outset that the views I express are personal and that each school or college is an individual entity, catering for the needs of its own environment, and must be viewed specifically in that light. What is appropriate in one area may be unsuited to another. Whilst some of the approaches discussed below may equally well be adopted elsewhere—indeed they are already in use in several areas—I in no way imply that they should be introduced generally, particularly if the work of school and college is clearly defined and the needs of all students are adequately met.

First, I think it is erroneous to think of senior educational institutions solely in terms of a particular age span: rather should they be considered in terms of educational function. Thus, I see no reason why youngsters of 14 or 15 should not spend part of their time at college—if that institution can better cater for some, or even one, of their needs—or why a 25 year-old should not return to the sixth form of a comprehensive school to study a particular academic subject at A-level, if his needs can be better met there.

Undoubtedly there are some things the school can do better, and some the college. GCE O- and A-level courses in academic subjects are normally better undertaken at school, though college may be preferable for viable groups of mature students requiring a 'rescue' operation. In addition to the various operative, craft, technician, technologist and professional courses which are its *metier*, college is the better place for O- and A-level courses in vocational subjects, such as law and accounting, which will be taught by professionally qualified and experienced staff. Students wishing to take some academic and some vocational subjects could be catered for by 'link' courses, spending part of their time at school and part at college.

Such link courses have become well established at my own college, Melton Mowbray. At the college we have some 300 pupils coming from the two neighbouring high schools and the upper school. At present, under the Leicestershire plan, all pupils move at 11 from junior schools to a high school, and thence at 14, to an upper school, unless they opt to do an extended year, in which case they remain at the high school until 15. When the school-leaving age is raised to 16 in 1972-3 the college will, thereafter, be dealing solely with the upper school, which will be catering for the full 14 to 19 secondary group.

For the high schools we offer college courses in engineering, automobile engineering and building. With some groups we rotate these courses among the three terms. For the upper school we offer a wide range of automobile engineering courses for the fourth and fifth forms, and share the sixth form A-level science course, the college concentrating upon the applied parts of the syllabus. In addition we allow the upper school the use of a carpentry workshop for a CSE class in building.

Staff relationships are the key to the successful development of link courses. There is scope for the development of team teaching and for joint staff meetings. Relationships between the heads of the local schools and myself are excellent. I will not pretend that we have always seen eye to eye, but we have always resolved our differences amicably and kept the best interests of the students as our guiding influence in decisions we have had to make. Similarly, there are good relationships and liaison between school and college staffs, and difficulties have been overcome by goodwill and co-operation from both sides.

Divided Loyalties

There have been difficulties in evolving these courses. At first some pupils had divided loyalties: some felt that the college course was merely 'time out from school' and caused disciplinary problems. In some cases, the offenders were also problems at school, but I found that some were only a problem at college. On investigation we derived the lesson that the college staff must not adopt a vocational approach with these youngsters in the same way that we do with part-time day students, but rather continue their general education slanted with a vocational bias. Certainly I think it would normally be unsuitable to aim for CGLI examinations with such pupils, though I think there is considerable scope for co-operating with schools for CSE, particularly for 'mode three' syllabuses.

In general terms, I feel that these link courses fulfil three main aims:

They give a more realistic 'bite' to students' studies and, in the spirit of Newsom, they become 'more active partners in their own education.' They may well gain incentives to work harder in their other subjects at school because of interest sparked off in a practical class in a college workshop.

They gain wider knowledge of both employment prospects and their own employment potential.

They learn something about associated FE. courses, and routes to qualifications alternative to O and A-levels and traditional degree type courses.

For the session 1968-69, the headmaster of the upper school and I have devised what we are calling a 'package deal' for the middle band of ability students in the 14 to 16 age group. They may opt for one of the following groups of subjects: general engineering, electrical engineering, automobile and agricultural engineering and building. Students will spend approximately eight hours per week at college doing practical work and associated studies, and there will be close inter-relationship between this work and the subjects they do at school. By such means we hope to accentuate the implementation of the recommendation in Newsom for 'an outward-looking emphasis to courses.' For the sixth form, joint courses are planned in business

studies, and later for secretarial, engineering, science and building subjects.

Additional staff equipment, materials and finance will be required by the college to meet these new courses, and a member of staff, at lecturer grade II level, will be appointed to be responsible for such link courses.

Undoubtedly there will be problems, but with goodwill all round I feel that these will be overcome and the best interests of the students served—this, throughout, must be our over-riding consideration, as Mr. C. R. English emphasised in *The Vocational Aspect*, October, 1967. Suitable selection, together with the various assessments made at school and college, should enable the student at 16, or 18, to say 'I am in the right position on the route to the qualification for which I now know I wish to aim.' Often in the past he has not been able to say this—perhaps through his own fault. We must ensure that, in the future, if he cannot say this, it will not be through our failure to cater for his needs.

It would appear that, at present, there is some duplication of staffing and facilities by some schools and colleges, yet often some under-use in both. Co-operation between the two institutions may lead to a reduction of capital expenditure and a fuller utilisation of the resources available.

If there is a tendency for this to be true at the present time, it is even more likely to be justified when the school-leaving age is raised. Then I foresee vast new opportunities in some areas for co-operative efforts, ideally carried out by having school and college on the same campus—and including also provision for youth club and WEA. accommodation.

Associated with this growth of link courses is the need for advice to school pupils on career prospects, appropriate qualifications and associated FE courses. The County Youth Employment Officer for Leicestershire has already organised secondment courses for secondary teachers, on which they spend a week in industry or commerce and also receive talks by college principals on FE courses and by youth employment officers on the service. Pupils my need to know in advance not only how many CSE or O or A-level subjects they must aim for, but which are the appropriate subjects. Some, in the middle band of O-levels, may need to be told that they should leave school and take an OND course at college, rather than stay on for A-levels at school. Others are just not ready to commit themselves at 16, and for these link courses may be ideal.

The youth employment officer's role is likely to increase. He may be required to advise in the early stages of a student's career at the upper school at 14—not so much in terms of careers advice as general vocational guidance, and also some guidance on self-assessment to facilitate the student's choice of course.

Many members of college staffs possess not only high professional qualifications but also valuable industrial and commercial experience and schools may wish to utilize their services in appropriate circumstances. On the other hand, there may well be specialists in the schools who could usefully include in their time-table some work taught at

the college—indeed, we have been doing this for years by engaging them as paid evening teachers.

Link with Work

Useful link courses might be established in business studies, engineering, brickwork, carpentry, electronics, science, catering and similar subjects. At the lower level, 14 to 16, these can be mounted in the spirit of Newsom to broaden the range of course and content, to link with the world of work, yet continuing their general education. The transition from school to work may thus be facilitated. Students may not necessarily pursue careers that are directly based on their link courses—indeed, they may pursue them merely as hobbies, or ascertain that such is, after all, not their chosen field.

In the 16 to 19 age range, link courses may be established for certain parts of the A-level syllabus, or for the vocational elements of other courses. Eventually, joint OND courses may become generally acceptable—though at present this issue is highly polemical. Should they become accepted, then the effects are likely to percolate down to what is done in the phase preceding 16, and a major re-organisation of secondary school curricula might be required.

Some students, on entering the sixth form, though knowing they are more suited to a vocational rather than an academic course, do not perhaps want to go to a 'strange' college. They are just beginning to enjoy the fruits of seniority: the sixth form itself, and its privileges and responsibilities; activities as a school prefect or monitor: house positions and privileges: places in senior sports teams, societies, clubs etc. The traditional type of sixth form may not have been the place for teenagers to reach maturity, nor bridge the gulf between school and work. The modern sixth form is, however, changing in nature. In Leicestershire, under the county plan for secondary education, a more responsible adult atmosphere is being inculcated—it is no longer that of the old grammar school.

With regard to maturity, who is to say when or how a teenager becomes mature? Davies and Gibson, in their excellent analysis *The Social Education of the Adolescent*,[1] profoundly remark:

> '. . . quite a number of young people are 'forced' to maturity in this or that field. There is little value in this superficial adultness. In fact it can do positive harm to individuals by cutting them off from their peers' acceptance. It often means little more than that they have learned tricks of behaviour accepted as indices of maturity a decade or more ago depending on the age of the adults concerned, and it can encourage attitudes and habits which are out of phase with much else in their developing personalities and which will stifle that quality of youthfulness already too rare in our society.'

and

> 'The Youth Service, and in part of their work the schools, can and should offer opportunities for the individual to increase the social skills through which he will be enabled to take his part in each new experience.'

It is my contention here that link courses will contribute not only to vocational and general education, but also to social education by the

[1] University of London Press.

variety of new relationships and situations which would otherwise not be available.

Let us hope that we who are teachers and educational administrators do not drift too far away from understanding the needs of today's youth; and, in our deliberations, let us not decide what we think is best for them, but what we can establish that they deserve. In this light we may best provide the most suitable environment, facilities and situations. As with the west Oxfordshire experiment, the result may mean the school headmaster telling a pupil to go to college; or the college principal directing an inquirer back to school. Certainly neither institution should be viewed as a threat to the other, but rather as equal partners in a co-operative venture for 'the provision of the best possible facilities for the education of senior students.'

Finally, I would suggest that there is now a need for a Newsom type report on the 16 to 18 age group. Many more youngsters will be wanting to enter the new type sixth forms, yet not all will be suitable, or even wish, to pursue the traditional academic A-level courses. They have a right to receive adequate provision, and I suggest that a new type of provision be made for them, irrespective of whether it is all or partly at school or at college. Our prime interest lies in catering for them, not planning the size of the institution. Staff interests must clearly be protected, but they may have to become more interchangeable between the various types of institution; alternatively, the future may lie in the boundary between senior school and college becoming increasingly blurred, until eventually the two merge into a single entity.

Technicians should be neither upgraded craftsmen nor failed professionals. They should be selected because they have the right qualities and the right education and training for the job.

Educating Technicians

H. W. FRENCH

A technician can be described as occupying the intermediate position between the craftsman and the professional man. In the engineering context, in which the concept first arose, the distinction is fairly clear: the 'professional man' is usually identified as the university-trained engineer, although there are countries where this level is reached by means of education and training wholly outside the university. The engineering craftsman, too, is fairly clearly defined. There are some occupations, however, even in the engineering field which are not easy to categorise. The technician often needs a considerable amount of the manual skill which is the main attribute of the craftsman. He needs, too, a sound background in mathematics, in science and in the technology of his occupation. In this respect he may well, in certain areas, approach the kind of academic background expected of his 'professional' colleague. Clear-cut lines of demarcation often do not exist; even in engineering there are many examples of technicians who have begun as craftsmen and who have added to their manual skills the necessary theoretical knowledge to enable them to do technicians' jobs successfully.

In recent years, the concept of the middle-level man, previously restricted largely to the field of engineering, has spread far outside it. In construction and architecture a number of jobs have grown up which are generally recognised as being at technician level. In science, there are many chemical technicians and metallurgical technicians. Technicians are also making vital contributions in the medical field, in hotel and catering work; and in food technology. The concept is a relatively new one in the business, commercial and clerical fields and it may be that some more acceptable term will have to be devised. But it seems obvious enough that if one can equate the copy-typist, clerical-assistant type of worker with the craftsman in the engineering field, and if business executives with bachelor of commerce degrees and equivalent qualifications (e.g. chartered accountants) are regarded, as they obviously must be, as at professional level, then there are intermediate posts at 'technician' level. Such posts might include personal secretary-assistants, auditors, and data processing personnel. Certain junior executive posts in local or national government service are also at this level.

Although there is a great variation in the types of technician produced in different countries, and many differences in the way in which their courses are organised, it is broadly true to say that in most countries it is possible to recognise two levels of technician, who may perhaps be

designated 'technicans' and 'advanced technicians'. Generally speaking, advanced technician courses are entered at the age of about 18 or 19, commonly at the end of full-time secondary schooling until that age. Such courses are usually of two or three years' duration, full time; or there may be part-time versions involving equivalent study. In some cases such courses are entered by students who have successfully completed lower technician courses. These are commonly begun at the age of 16, and usually last two years. Many courses are particularly suitable for women.

Whilst there is a bewildering variety of technican courses and many differences in their organisation between the various countries, there are certain common factors. For example, most technician courses can be regarded as having five constituent elements, namely: (i) technical education (theory), (ii) technical education (practical), (iii) technology (theory), (iv) technology (practical) and (v) general education.

Frequently, in discussion, these five elements are coalesced to form two—'education' and 'training'. Whilst the boundary between the two is ill-defined, 'education' can be considered to embrace (i), (ii), (v), and commonly part of (iii), while 'training' consists of (iv) and the rest of (iii).

By technical education (theory) is meant that general background of mathematics, physics, chemistry, engineering drawing (or whatever subjects are relevant to the particular course) which constitute the theory upon which depends a proper understanding of the necessary techniques. This technical basis should also be sufficient to enable the technician to cope, without too much difficulty, with developments which might arise in his field after he has qualified.

By technical education (practical) is meant the laboratory and experimental work which is concomitant with the theory. Clearly it should be normal for this work to be done in proper relation to the theory, but it has been listed separately because such an arrangement is not always possible. For example, it may be that the theory has to be provided by correspondence, in which case the laboratory work may have to be done in a solid block of full-time attendance.

Technology (theory) means the theory relevant to the actual equipment with which the technician is concerned and to the specific techniques which he has to exercise. It is frequently useful to link this with the basic theory and with the laboratory work; and it is often very difficult to draw a clear distinction between them.

Technology (practical) means the acquisition of the necessary skills which the technician needs to do his job. This may well include basic manual skills similar to those possessed by the corresponding craftsmen. It may well involve the making of skilled measurements, of tests both simple and complicated. Commonly, the work involves an element of judgement and the intelligent application of background theory. Thus there is much to be said for this work also being integrated with the theory and perhaps, to some extent, with the technical education; but here, again, such an arrangement is not possible if correspondence course methods are used. Also, where the practical technology is acquired by training within industry, as in some cases it may be, there are difficulties in organising the course in such a way as to ensure that the relevant theory is known by the time the corresponding practical

work is reached. One thing is certain—the ultimate valuation which will be placed upon a technician will be in terms of his success in doing a practical job of work; his theory is but a background to enable him to do practical work with certainty and expedition, and to equip him to continue to do this even if equipment and methods change. The 'theoretical technician' is a failure.

Thus, whilst each of the five elements in any course is important, the practical technology is particularly so. This is stressed because courses have been encountered in which the theory has been good and the practical work poor. Often this has been because the teachers themselves have lacked practical experience in the work they are trying to teach.

Finally, all technician courses, but particularly those for junior technicians, need a general education content. One major element in this should be communication, both in speech and writing. A technician is often called upon to diagnose faults and to report upon them; for this he needs to be able to express himself clearly and succinctly. Frequently, too, a technician has to give instruction to others, and these instructions must be simple and unambiguous. Many technicians have to exercise a measure of supervisory responsibility. Not only should they be taught the principles involved, but such teaching should be used as a vehicle for exercising communication skills.

Importance of the Job

An important objective in general education should be to imbue the student with a clear concept of the importance of the job for which he is training. This should include a picture of his place in the firm, business or government department in which he is, or may be employed, the place of the firm or business within industry, and the importance of the industry to the nation's economy in relation to the rest of the world. He should be given a clear conception of how local and national government operates, as well as a glimpse of international affairs. This part of his education should include such matters as employer-labour relationships and the elements of economics. Liberal education should not be ignored, and may take the form of lectures on literature, art, and music organised perhaps as extra-curricular activities. With junior technicians it is appropriate to spend a good proportion of this time enhancing the basic education of the student. For senior technician courses, the emphasis may properly shift towards the supervisory and industrial relations content.

A course may be made up of one day a week in college and four in industry. This naturally has an influence on the proportions in which the five constituent elements mentioned earlier are introduced. In a full-time course all the elements are under the control of the college and the integration of theory and practice can be obtained. But certain factors may offset this obvious advantage. Commonly, the technical and general education may be provided very well in a full-time college; but the technology is sometimes limited, perhaps by available equipment but much more frequently by a lack of the practical industrial or commercial situation. Because of this, the technology practical work may be on a smaller scale than is met within industry; it may well have an element of artificiality about it. This will obviously

be so in, for example, such courses as plant engineering, civil engineering, and others relating to heavy industry. The students may then lack the inherent urgency and interest which attaches to work being done as part of a production, maintenance or business job—there is something real and important in what the French call *l'esprit d'enterprise*. The technician apprentice in the United Kingdom may well find himself learning by planned practical work in a production shop or in a drawing office in which the drawings are not merely exercises but the early stages of work which will end in saleable hardware. Where wholly institutional courses are inevitable, all possible steps should be taken to simulate, in the practical work, industrial or commercial conditions. This should extend to normal works or office discipline during the technology work and to the observance of normal stores production and office procedures.

One method of resolving the difficulty referred to above is to leave the technology part of industry, by organising the course on an 'open sandwich' arrangement. In this, all five elements of the course are provided in the college for the first year but in the second year the technology (practical) element is largely omitted. It is subsequently provided as planned training within industry, the practical work being designed jointly by the college and industry, and the award of a diploma withheld until after the successful completion of the industrial training period. The restriction of the industrial training arrangement to the second year is justified on the grounds that the practical training in the first year necessarily includes a proportion of work involving basic skills, such as colleges can provide without much difficulty. It is in the later stage of the course that the practical technology may involve equipment and installations which a college may have difficulty in providing. By using the facilities of industry, not only is this difficulty overcome, but so is the problem of achieving an industrial atmosphere. A further step is the sandwich course, in which the practical technology is provided by employers in each year of the course, with the immense advantage of training in an industrial or business environment. The cost is administrative complexity and there is a real problem in having practical technology in the hands of one person and the relevant theory in those of another. Another problem is that, if the theoretical work is concentrated into one half of each year, it may well be forgotten during the other. Many sandwich courses are therefore organised so that, during the works period, there is either some part-time—commonly evening—attendance at the college, or else the link is maintained by correspondence work.

The half-and-half arrangement of the 'sandwich' course has the great advantage that it can be organised 'end-on': two courses running concurrently, one being in college whilst the other is in the works. This method can maximise the usage of both college and works training facilities, but is only completely appropriate for those courses where practical technology properly constitutes nearly 50 per cent of the course.

There are some courses, often of longer total duration than the full-time integrated course or the sandwich course, where the length of college attendance may be much less than six months a year. Some 'block-release' courses involve about twelve weeks of college attendance per year, others sixteen or eighteen weeks. Such an arrangement

provides for a higher proportion of practical technology than the half-and-half course and it is necessary to ensure, as far as possible, that the relevant theory is covered before the practical technology is undertaken. In the later stages of the course, the practical training may well involve some production or equivalent work; that is the training may be extended to include an experience element. This kind of arrangement also leads to the problem of continuity between the college periods, which may be solved either by occasional (usually evening) attendance or by correspondence assignments. This system too can bring about a highly efficient use of facilities. If colleges are open for forty-eight weeks a year, and there are twelve weeks of college attendance, then clearly five trainees can be handled for every four industrial training places. If the courses are of sixteen weeks duration in college, then four trainees can be handled for every three industrial training places available.

Day release is a normal arrangement for engineering and science technicians in the United Kingdom, and is now extending into the business studies and other fields. Many educationalists feel that the 'weekly dose' of college has much to commend it, compared with the concentrated effort required in block-release courses and the 'forgetting periods' between. Even so, there is now a body of evidence which shows that, in terms of examination results, technician students do better on block release than on day-release courses. This may well be because the actual time devoted to educational studies is greater for block-release students than for part-time day students, for whom, in many courses, it is all too little. A 12-week block-release course involves about 360 hours of attendance, augmented by, perhaps, from 50 to 100 hours of evening attendance during 'link' periods. For 18-week courses, the corresponding period may be 540 hours during the block, plus 40 to 80 during the link periods. On a day-release scheme the commonest arrangement is a seven-hour day for 38 weeks, giving 266 hours. At most, a seven-and-a-half-hour day augmented by a two-and-a-half-hour evening would give 380 hours. Many educationalists take the view that the day-release arrangement, however adequate for craft training, provides an inappropriate ratio of education and training for technicians, because of the greater theory content of their courses. Thus there is a trend towards block-release courses for technicians, although block-release students still constitute a minority.

In part-time day arrangements, as indeed in all schemes which involve carrying out the training within industry, the question of the quality and the control of the training looms large. Some firms and some nationalised industries provide technician training of high quality which, by close liaison with the colleges providing the education element, proves that day-release arrangements can work well. These courses often get the ratio of the five constituents nearer the appropriate balance by giving students not only the technology (practical) element, but also a measure of the technology theory. Much of what they do, at any rate in the early part of the course, is provided in 'training bays' or in some other accommodation within the works, but which is not part of the actual production facilities.

The British part-time day arrangement developed historically from the situation some fifty years ago, when craftsmen and technicians picked

up their practical knowledge as best they could on the job and acquired their technical education by voluntarily attending evening classes, commonly for three evenings a week. The Department of Education and Science has stated firmly that technicians should not have to obtain their technical education by evening studies alone; that they should, at least, be given day-release, but preferably, their courses should be of the block-release, sandwich or integrated full-time nature. It may perhaps be necessary for some evening courses to be provided for adult students who have missed the opportunity of obtaining normal technician courses at apprenticeship age or who, having as apprentices reached the junior technician level, wish to obtain an advanced technician qualification. It is for consideration, however, whether a firm which is suffering from a shortage of advanced technicians, as many are, might not be better advised to offer day-release or block-release even to adult students.

Technician as Craftsman

The technician—particularly in developing countries—needs to possess, in considerable measure, the same manipulative skills as the corresponding craftsman. Thus a case can be made out for providing courses for technicians in the same establishment as those for craftsmen. The technician would thus acquire an understanding of the abilities and outlook of the craftsman with whom he may have to work closely later. (This arrangement has the advantage, too, that outstanding craft students may be readily transferred to technician courses.) Also it is of great importance to educate the technician in an environment in which he can acquire a pride in his function, which he may well not do if he is trained in a university. The point does not arise to the same extent in the craftsman-technician relation, for the craftsman has an established position in his own right, based on a pride in his manual skills. The technician, on the other hand, has as yet no well-established traditions. He does not in general possess the manual skill of the craftsman, and he lacks the academic backgound of the graduate. Thus it is vital to educate him under conditions which develop his standing and his self-esteem. In this country the technician was for many years educated through the medium of a course which endeavoured to provide both technician and professional qualifications. This not only produced a distortion of the curriculum, as far as technician needs were concerned, but resulted in only a minority of students reaching the professional level. Thus the image of the technician as the 'failed professional' tended to emerge. Recent developments in courses specifically for technicians will, it is confidently expected, rectify this situation.

The increasing tempo of technological progress makes it certain that no initial training, whether at craft, technician or professional level, will suffice for the worker's whole career. Thus the first technician qualification will undoubtedly have to be augmented, perhaps several times in the technician's working life, by means of extended courses. One can distinguish three broad types of extension courses for the qualified technician namely, (a) those that raise the level of his existing qualifications; (b) those which extend the range of his existing knowledge without raising the level; and (c) 'up-dating' courses. The most obvious example of (a) is the course which raises the 'technician' to

'advanced technician' level. This may involve some two years on a sandwich or full-time basis or longer by part-time study. Another example might be the course for the advanced electronics technician who takes one of the specialist subjects he has studied earlier to a higher level. He might, for example, take a special course in microwave electronics, or multi-channel radio telephony or a host of others. Yet another case might be the production technician who is sent on a work study course or a course of supervisory studies. Such courses may take place in colleges or in firms, according to subject, and can be anything from a week-end to six months full-time. Examples of (b) are obvious enough. Technician courses often provide options in the final year, and it may be that the needs of a particular firm include a broader knowledge than the available course options permit. For example, an electrical technician course may provide electrical power (supply) and electrical power (utilisation) as mutually exclusive options. A particular company may require some of its technicians to be competent at both. The remedy may be to arrange a special course of, perhaps, three months full-time. As for 'up-dating' courses one can hardly indicate any sort of pattern for them. A firm about to install spark erosion equipment may organise a three-day to a week's course on the subject. Another, about to introduce computer control of its machine tools, may need a short course, perhaps with the computer company, for some of its technicians. There is no doubt that, in almost all fields of technician endeavour, 'up-dating' courses will play a vital part in the future.

The status of the technician is a problem which has beset all countries which recognise the need to recruit good people to technician course s In most of the advanced industrial countries technicians have, until recently, arrived at their positions by one of two methods. One has been by the upgrading of tradesmen. It is to be hoped that this will, in some measure, continue. But it is a bad thing for the majority of a country's technicians to come this way. Not only does it fail to take account of the fact that, in most technician fields a different level of entrant and a different kind of training are required from those appropriate to tradesmen, but it tends to identify the technician's status too closely with that of the craftsman. The second method is even more to be deprecated. It is that of producing technicians by the method of professional failure; that is, by recruiting as technicians those who fail in their university courses. It is obviously a bad thing for any body of workers to be regarded—and to regard themselves—as a collection of failures at something else. A group needs an ethos of its own; and for this reason it is important that the main body of a country's technicians, shall consist of people who have aimed at becoming technicians, have been selected as having the appropriate qualities, and have been successfully educated and trained. The 'up graded craftsman' and the 'failed professional' should be minority groups in this body to which, if it has the appropriate status, they should be proud to belong.

When Nature *published a report on experimental work in a British school it gave rise to considerable correspondence. This article reviews the present situation and suggests a code to govern the practice of experiments on living material.*

Practical Biology

Some controversial aspects

O. J. E. PULLEN

Beware, my son said Euphronius, *of observing spectacles of pain and misery with delight. Cruelty, by insensible degrees, will steal into your heart; and every generous principle of your nature will then be subverted. The philosopher, who has in contemplation the establishment of some important truth, or the discovery of what will tend to the advancement of real science, and to the good and happiness of mankind, may perhaps be justified, if he sacrifice to his pursuits the life or enjoyment of an inferior animal. But the emotions of humanity should never be stifled in his breast; his trials should be made with tenderness, repeated with reluctance, and carried no farther than the object in view unavoidably requires.*

Wanton experiments on living creatures, and even those which are merely subservient to the gratification of curiosity, merit the severest censure. They degrade the man of letters into a brute, and are fit amusements only for the cannibals of New Zealand. I condemn myself for the indulgence which I just now shewed you. But I knew that your fishes would endure less pain from an instantaneous than from the lingering death which awaited them; and I little expected that your compassionate and amiable heart could have received a pleasurable impress on such an occasion.[1]

Biology, involving as it must the experimental study of living things (including the pupils themselves), can raise some controversial issues. The first of these is the extent to which experimental work with living things, however humble in organisation, affect the susceptibilities of children who, to give extremes, may be inordinately sensitive about interference with living creatures or so insensitive that they are callous in their attitude to other forms of life.

The second arises from the need to kill animals for experimental work and for dissections. Is there a case for insisting that this should never be done in the presence of pupils? Can we make an exception for older pupils who are likely to be embarking on careers in medicine, or as vets or nurses? If so, ought we to discourage pithing of frogs and methods of killing which might cause revulsion or involve cruelty? Can we reconcile our attitude with the fact that aspects of rural studies involve the rearing of livestock for food and that many a country child is already expert at killing poultry and rabbits expeditiously and probably painlessly?

Experiments involving pupils themselves carry certain special risks-

[1] *Reading Exercises for the Use of Schools by* Rev. David Blain (London, 1811)

(a) infectious diseases can be spread by methods used in taking blood samples;
(b) there are dangers in carrying demonstrations of breathing effects to extreme;
(c) the heart can be affected by violent exercise;
(d) children might be prompted to carry out unsupervised experiments with the attendant hazards;

These issues must concern us all and are particularly pressing at present because Nuffield projects give great prominence to experimental work, and American ideas, as in the Biological Sciences Curriculum Study material, include experiments which, in interference with the normal functions of living creatures, go well beyond anything previously attempted in our schools.

Allied with these issues are such questions as the destruction of pests (insects and weeds particularly) by chemical means. This may involve moral issues about man's right to destroy life, the risks of destroying harmless or beneficial forms of life, and the risk, already shown to be considerable, of residual chemicals in soil or in plant and animal produce, which are inimical to the life of other creatures and to man himself. Finally there is the major question of food problems and of conservation.

There are also, it must be noted, ethical and practical issues involved in the keeping of living creatures in captivity. For instance the standards to be set in living conditions for such small animals as mice used in genetic demonstrations and the desirability of keeping 'wild' as distinct from domesticated creatures in captivity. Should long-term captivity be tolerated, or should we insist on it being reduced to the shortest possible periods for purposes of observation and experiment? Intensive methods of live-stock husbandry such as several birds sharing a battery cage, 'sweat-box' methods of pig husbandry or deep-litter methods of poultry keeping are highly controversial issues and schools may be using such methods on a small scale.

These issues are so controversial and can arouse such complex emotions that one cannot expect to get agreement on many of them. Every pupil, teacher, or HMI must be free to take his own line; no pupil should suffer ridicule if his views differ from those of his fellows.

Variations in Human Nature

The effect on pupils of almost all educational processes is hard—sometimes impossible—to assess, and much must remain a matter of faith. One must also remember the variation in human nature. What may seem appropriate to the vast majority may be wrong for the minority and there may always be in a class an individual exhibiting such a wide deviation from normal that disastrous effects can result. In all teaching we must expect to take risks. It is usually impossible to cater for everyone; but it is desirable to be aware of the risks we run. Our faith in an experimental approach to biology rests on certain major foundations which are worth re-stating:

(1) An enquiring approach is always stimulating since it canalises natural curiosity and keeps many faculties alert. Furthermore it may foster the scepticism and habits of thought of the scientist.
(2) Biology can be used to provide the discipline of working with

many variables, the opportunities to use genuine control experiments, and the chance of raising problems, often apparently quite simple, to which the answer is not known.

(3) There is a particular fascination about working with living material and, if fostered, this should enhance wonderment at the complexity, intricacy and mystery of phenomena of life, and respect for life.

Nevertheless it must be pointed out that work ought not be allowed to give curiosity free reign. The criticism that experiments merely confirm what is already well known from medical research must be avoided. Some confirmatory work—preferably by demonstration in which one animal only is used (or the teacher himself)—is justified for the interest it arouses; but we should attempt to assess 'educational advantage' in all work and particularly when it involves death or discomfort to other creatures and experiments by pupils on the systems of their own bodies. The work must help to throw light on some question under discussion or bring it home to the pupil more vividly than can be done with 'chalk and talk and charts.'

We must avoid sentimentality—and discuss this with pupils—while retaining a balanced outlook and fostering respect for life. To survive man must destroy other creatures; he must keep them in captivity. As the years have passed his attitude to these things has changed. Killing at abattoirs is carefully controlled and cruelty is avoided as far as possible. Pests must be controlled, but our knowledge of how and when and how far to go is not perfect. In this country an attempt is made to keep the effects under review. Biology should help future citizens to understand the problems and to develop a balanced outlook towards conservation in general. Similarly with domestication—we know it can give farm animals greater comfort, freedom from disease and predators, longer life, assured food supplies; very different conditions from those of life in the wild or on free range.

Finally, we can try to get an agreed code with which most would be happy to comply. An attempt to draw up such a code follows:

(1) Biology lessons should consciously attempt to foster curiosity about life processes and with it a sense of wonder at the beauty, intricacy and mystery of life. This should enhance a pupil's respect for life, and his aesthetic appreciation of many features of the biosphere.

(2) In biology, teacher and pupils should develop a proper attitude towards the living material they use in their enquiries; housing it in conditions which endure the highest standards of comfort and which approximate to those in natural habitats; using it in enquiries only if some educational advantage seems likely to accrue—such gains must be carefully assessed.

(3) Enquiries involving living creatures should never be open to the objection that the temporary discomfort caused to the subject is not justifiable, either because little is gained by the work, or because the discomfort suffered is such that it borders on cruelty. (Experiments using mammals in a search for new knowledge are out of the question because they are controlled by a licencing system which concerns only recognised research establishments).

(4) Painless killing (euthanasia) must be the rule in biology laboratories when living creatures are killed for teaching purposes. As a general

rule it should not be carried out in the presence of pupils. The only suitable exceptions would be to give experience in painless killing to older pupils such as those preparing for careers in laboratories or in medicine or agriculture, and those pupils following rural studies courses who are gaining experience in preparing produce for the kitchen or shop.

(5) Domesticated animals kept in captivity must be housed comfortably and there should be high standards of general cleanliness and in the routine needed for provision of food and water. Conditions should approximate to those found in natural habitats (as far as these are known). Numbers in captivity should be no more than necessary for lesson purposes or for training in proper care of pets. It is seldom wise to lavish affection on pet animals and risks from the diseases they may carry should be thoroughly understood. Animals needed for killing and dissection should be well treated, but not as pets.

(6) Wild animals, even small water creatures, should not be kept captive for periods longer than is necessary for observation and enquiries. When lengthy periods of captivity are planned conditions should be very near those of natural habitats. At the completion of a study the creatures should be returned to their natural haunts.

(7) Teachers should discuss with pupils the case for dissection and experiments with animals, stressing what it is hoped to gain from the work and emphasising that no animals, however small and primitive, will be used longer than is necessary. In other words wasteful and inconsiderate use of living material will be avoided.

(8) Similarly, man's place in nature should be fully discussed, his exploitation of the plant and animal kingdoms for food and other needs, his constant struggle with rival elements—pests and predators—his dependence on plants and beneficial creatures, and his need, and duty to be as wise as possible about destruction of other forms of life and about conservation of all natural resources.

When the Dainton report on the flow of candidates in science and technology into higher education was published, Trends *asked two headmasters to examine its recommendations from the schools' point of view. Their response is printed on the following pages. First, for the convenience of readers, we reproduce the summary of recommendations from the report.*

Dainton and the Schools

What Dainton recommended:

(1) There should be a broad span of studies in the sixth forms of schools, and irreversible decisions for or against science, engineering and technology should be postponed as late as possible.

(2) Normally, all pupils should study mathematics until they leave school; the teaching of mathematics should show the effects of associating mathematical thinking with other studies, such as experimental or engineering sciences, or with economics.

(3) Breadth, humanity and up-to-dateness must be infused into the science curriculum and its teaching.

(4) Schools and Local Education Authorities should take steps to ensure that within the next five years the majority of pupils in secondary education should come into early contact with good science teaching.

(5) The foregoing objectives are to some extent met in Scotland. It is important that the traditionally broad base of Scottish education should be preserved.

(6) The participation of teachers in in-service courses should be encouraged; financial incentives should be provided and flexible arrangements for replacement should be developed; the need is especially great in science and technology.

(7) The deployment of teachers should be reviewed in order to ensure that younger and uncommitted pupils receive high quality teaching in science.

(8) More graduates of high ability should be recruited into science teaching and positive incentives should be offered to them.

(9) Urgent consideration should be given to an increase of technical supporting staff in schools; advances in educational technology should be fully explored in the teaching of science and mathematics; Local Education Authorities should recognise the additional cost of curriculum reform and should be prepared to finance promising new proposals.

(10) Universities should reconsider their entry requirements with a view to encouraging a broad span of studies in the sixth form and

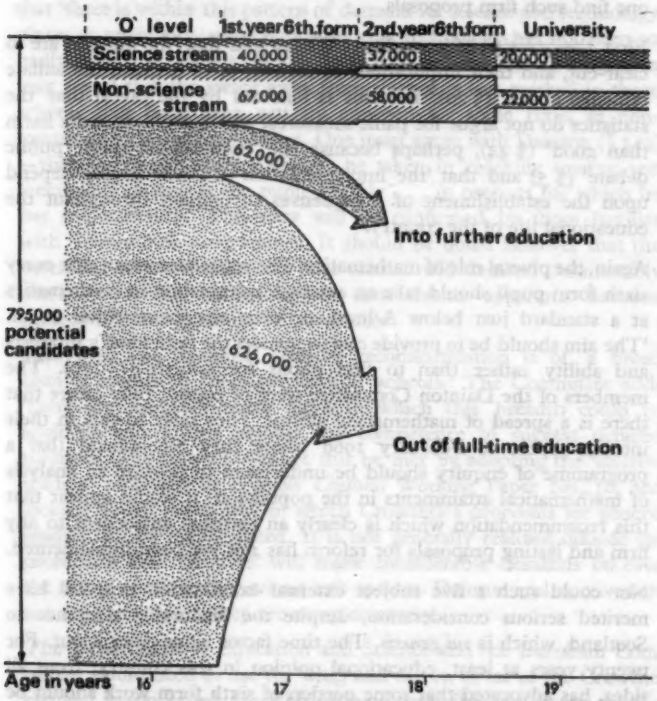
to increasing the flow of candidates in science, engineering and technology.

(11) Universities should further experiment with new courses in science, engineering and technology designed to attract to these disciplines able entrants who are not already committed to these fields of study.

(12) Employers should recognise their high responsibility for ensuring that careers in science, engineering and technology are made as attractive as possible to students.

(13) There should be continuing review of trends in subject specialisation and their implications for manpower; research into career choice should continue; statistics on the flow of pupils from education through to employment should be further developed.

Flow of pupils through schools into higher education



In many schools the science stream begins to emerge two years before O-level, but this is the first point where national trends can be seen. Even beyond O-level there are losses from the science and non-science streams; the likelihood of movement between them decreases as they progress towards higher education.

The science stream is almost the only source of university intake in science and technology; it also provides most of the entrants to medicine and dentistry.

A School View I

H. FRAZER

The Dainton report is a valuable and honest document. The portions that fall within the committee's strict terms of reference, and within their sphere of competence, are written with precision. Other sections demand more careful reading and study.

Many people have been led to believe that the report advocates an immediate change to five subjects externally examined at the end of the sixth form course: mathematics (being compulsory)—one from each of the main groups, science, social studies and arts—together with one optional subject. This is not so. Nowhere in the report can one find such firm proposals.

First, the question of immediacy. We are told that 'the findings are so clear-cut, and their implications so serious, as to demand immediate remedial action' (§ 20). But this is followed by the caveat that 'the statistics do not argue for panic measures, which could do more harm than good' (§ 44), perhaps because the 'implications merit public debate' (§ 5) and that 'the implementation . . . will largely depend upon the establishment of a consensus of opinion throughout the educational life of the country.'

Again, the pivotal role of mathematics. The suggestion is not that every sixth form pupil should take an external examination in mathematics at a standard just below A-level, or even any examination at all. 'The aim should be to provide *courses* to meet the individual's interests and ability rather than to find pupils for courses' (§ 179). The members of the Dainton Committee were of course, fully aware that there is a spread of mathematical ability. They refer to this in their interim report of February 1966 where they recommend that a programme of enquiry should be undertaken to provide an analysis of mathematical attainments in the population: it would appear that this recommendation which is clearly an essential antecedent to any firm and lasting proposals for reform has not yet been implemented.

Nor could such a five subject external examination proposal have merited serious consideration, despite the favourable reference to Scotland, which is *sui generis*. The time factor alone rules it out. For twenty years at least, educational opinion in this country, from all sides, has advocated that some portion of sixth form work should be unexamined. This has not been challenged. As early as 1947, the unanimous report of the Secondary School Examination Council (the Morris report, that led to the introductuion of the GCE) expressed the hope that the schools '. . . will regard it as essential that the pupils' courses shall be sufficiently wider than the subjects which they are offering for external examination.' In 1959, Crowther concurred with this view that 'there are decisive objections to any imposed external examination of complementary studies' (§ 417). The Schools Council Working Paper No. 16 (1967) emphatically reinforced this view: 'It is regarded as essential that there should be some part of the sixth form curriculum which is free from any kind of assessment,

partly so as to lessen the total pressures on the pupils and partly so as to enable staff and pupils to follow their own particular interests' (§34).

Further, such a full and inflexible external examination programme would have damaged those very schools that Dainton would wish to encourage. Many committed schools, following Crowther's 'alternative road,' are deeply involved in the Schools Council 'Project Technology'. The schools are not only setting alight school enthusiasms for applied science and technology, they are also stimulating the study of mathematics. Other schools, too, are being influenced. During the past six months alone, five hundred additional schools have asked to be associated with the scheme. They are requesting assistance to set up applied science project work. Some of the pioneer schools prefer their work in this field to be wholly divorced from examination or assessment; in their view assessments of any kind would remove some of the elasticity of approach. But the main objection is that it would affect the present teacher-pupil relationship. One is not surprised to read that 'there is within this pattern of demand for science and technology places at university, some indication that technology has not been so badly placed as science' (§ 31). It would well be that investigation may reveal that the swing away from science is less marked in those schools that have been actively engaged for some time, in non-examined technological studies. One must agree with Dainton (§ 149) —that 'every opportunity should be taken in teaching science and technology to engage the pupil directly . . . in projects for which he has responsibility.' This view will be confirmed by those familiar with *Science Fair* programmes. It should be noted however that the extension of project work to pure science will demand considerably more space: for dismantling of cumbersome apparatus between periods will not generally be practicable.

The 'first and foremost' Dainton recommendation is of 'a broad span of studies in the sixth form of schools.' The Committee adds 'there are probably many ways in which this breadth could be achieved and it lies beyond our competence to suggest detailed solutions (§§ 174, 176). Cannot this be met by adopting the 'elective studies' proposals in Schools Council Working Paper No. 16, and looking afresh at the way in which Crowther's proposals for general studies can be implemented. It is not generally realized outside the profession that 'electives' will make considerable demands on even the skilful teacher: they are no soft options. Dainton and electives are not only consistent, they are complementary.

The Department of Education and Science and the Burnham Committee would need to use the whip and carrot, as far as the Crowther element is concerned, the whip being a prescribed minimum number of periods devoted to general studies as a condition precedent for admission to the category of efficient schools, and the carrot, a mandatory additional head of department payment to a 'Coordinator of General Studies.' Could not the Burnham points system too be amended to include not only a weighting for age, but also a factor dependent on the number of 'science pupil-hours' in the sixth form?

The proposal that 'normally all pupils should study mathematics until they leave school' (§ 179) can only be met in this country, (if it can be met at all at present in the sixth form) under the umbrella of advanced, electives and Crowther's complementary studies. There

would need to be at least four categories of courses—for the committed, the uncommitted, the reluctant and the retarded. In many cases, as the report agrees, these courses would have to be tailored to meet individual needs and pressures. What would meet the circumstances of one particular school might be wholly inappropriate for a neighbouring school. This cannot be done for all pupils, nor even for the majority of pupils, through the medium of a nationally controlled external examination; nor even, during the initial remedial period, through normal mode 3 processes.

In these difficult circumstances, any attempts by university departments of mathematics to set up special entrance examinations to aid their selection procedures should generally be regarded as a pressure against the national interest. As the interim report remarks, there should be 'an examination of selection and qualifying procedures to ensure that individuals with the necessary qualities of character, imagination and originality for careers in science and technology are not excluded on purely academic criteria' (§ 22). Incidentally, it is an odd fact—in view of the present emergency—that A-level 'technical' subjects are not generally acceptable as such for university entrance purposes.

One inevitable consequence of the Dainton recommendation will be a reduction in the amount of manpower available for mathematics teaching below the sixth form, no matter how efficient the deployment of the resources of the whole area of a local authority. One must remember that some primary teachers of mathematics dropped mathematics at the age of thirteen.

Can this reduction in time be counter-balanced in any way by increased productivity? Shall we be driven to replace O-level, in mathematics at least, by a process of continuous assessment? Some believe that this would be a fortunate circumstance and a big leap forward. They believe that this would result in higher standards and less reluctant pupils: it would most certainly save time. But it is encouraging to know, if this comes about, that 'it is possible for teachers to produce assessments which are as reliable and valid as any examination which may emanate from external sources.'[1]

In the Chapter of the Report 'Trends in some other Countries,' there are references to the Netherlands, Germany, France and the United States. There is no reference to Hungary where according to Professor Goodstein, they have produced in the last hundred years a greater number of first class mathematicians per unit of population than any other country in the world. (Finland is second, far behind). An investigation into mathematics in Hungary may provide some useful leads. During a British Council visit there a few years ago, I was informed that an advanced pass in mathematics was essential for university admission. This was, of course, an earnest of their determination to harness all their resources to the technological drive. Special schools have recently been established to explore new approaches to the subject.

The co-operation between schools that Dainton advocates (§ 185) may well arise through the agency of the CSE groups and subject

[1] *Teachers' Experience of School Based Examining*—Schools Council Examination Bulletin No. 15. (§ 66).

committees. Never before in the history of English education have there been closer contacts between subject teachers in secondary schools of all kinds; far more than the Beloe Committee could reasonably have hoped to achieve. And because of the establishment of local mathematics and science centres, there has been vertical integration too—infant, junior and secondary teachers meeting together in school time. There has been a mutual enrichment of experience and cross-fertilisation across the age group, especially in the field of the 'new' mathematics. Some secondary teachers have even 'adopted' a primary school—how valuable this can be? And all this at a time when the Schools Council is actively urging examing bodies to encourage mode 3 ordinary level examinations. The gap between CSE and O-level is closing—and, what is equally important, the psychological barrier between the two is being breached.

If the Council for Scientific Policy had envisaged that the working group that it set up to examine the flow of candidates in science and technology into higher education, would find themselves compelled to deal with school matters falling outside their strict terms of reference, the distinguished members of the Committee would perhaps have been joined by practising teachers, specially teachers with first-hand knowledge of O-level problems. Had this been so, it could well be that a different priority would have been established for reform. The main attack could perhaps then have been on the ordinary level curriculum.

In view of the urgency of the situation, there is much to be said for an early reduction of the present nine O-level grades to three: the present grades 1,2,3 to be 1; 4,5,6 to be 2; and 7,8,9 to be 3. Those involved in the administration of external examinations at the national level, will agree that in some subjects (biology is a good example) the curve of marks is flat: fine grading is an artificial exercise. And yet these grades do, unfortunately, influence attitudes to study in the sixth form. Further, the suggestion that 'criteria for entry into higher education would need to include one based on overall assessment of the sixth form course and examination' (§ 176) will inevitably bring university pressures on O-level work in the schools. The only school examination evidence before the selection boards in particular subjects, would be O-level results. These grades would be carefully scrutinised despite the fact that it is generally agreed that O-level performance is no adequate guide to university performance. What effect would this have on schools with express streams? How would it alter the practice of schools that now by-pass O-level? Does not this, too, strengthen the case for assimilating CSE grades 1 and 2?

Is there a danger too that the recommendations to 'take steps that will ensure that within the next five years pupils . . . should come into early contact with up-to-date relevant and attractive teaching of science' (§ 182) will be read without heeding the warning in (§ 10), that there should be 'study of the effects of experiments and reform such as the works of the Nuffield Foundation.' Some authorities may attempt to implement (§ 182) by the early proliferation of Nuffield O-level courses. Would it not be wiser to await Nuffield evaluation?

A School View II

E. W. MAYNARD POTTS

On finishing reading the Dainton report I found myself wishing to rewrite chapter VII diagnosing the trend away from science.

In the early 1960's boys applying to universities to read mathematics or mathematical science were told that grades of A or B would be necessary; girls were often given grade A as a condition. Among heads the story circulated of the university with a mathematical staff of six which had achieved an output of four honours graduates in one year. Headmasters set up a working party with university and further education representatives to discuss how we could use the good, as well as the very good, mathematicians from our sixth forms.

Our school had—and still has—a very good mathematics department, well supported by large numbers in the sixth form. Rather than waste these mathematicians I have encouraged the linking of mathematics with history, geography, biology, economics, art and technical studies. Some of the university fields of study to gain were mathematical economics, statistics, architecture, planning, biochemistry and, in further education, computer programming and engineering design.

The period of prodigal rejection of sixth form mathematical scientists was followed by the development of colleges of advanced technology, the expansion of university places for mathematics and science as well as the recent formation of polytechnics on a technical college base. The steady growth of mathematics and science in our sixth forms could not keep pace with this expansion. The polytechnics have adjusted themselves to a shortage of scientists and a good supply of non-scientific sixth formers by tending to develop into liberal arts colleges with a strong bias towards social and professional studies.

Recently in the schools we have become aware that it is now safe for us to expand mathematics, science and technology. What one might call my own 'Dainton report' was issued to parents and pupils on January 24, 1967; it encouraged pupils, particularly girls, to consider moving towards specialisation in mathematics and science. Movement in that direction is quite marked among fourth year girls but my advice was too late to affect the present sixth form. In four years' time with the halt in university expansion we may again be producing more good scientists than the universities can take. How soon ought I to advise another retreat from science?

Each year I have regular talks with the ninety fourteen-year-old boys and girls and the ninety sixteen-year-olds. I learn from them about the trends of adolescent thought and I offer them advice in return. Earlier this century our hopes were pinned on scientific invention in times of war as well as in peace but now our pupils see that it is not the men who develop colour television who win public acclaim. Rather it is the men who use it to manipulate public opinion, or the managing directors of the companies which sell the sets or, still more, the young men and women who make rapid fortunes as performers. Power today is seen to be with the talkers rather than the inventors;

those who protest dominate those who create; the patient and logical discipline of science is less acceptable when life offers so many rewards to the undisciplined who overthrow the established order without troubling to study logically the consequences of the actions which they provoke. The press suggests that the future for the scientist, the technologist and the medical research worker is in the United States, away from frustration by financier or politician.

New mathematics with its modes of thought applicable to organisation and planning is seen to be valuable by many pupils. With the aid of computers they believe they will solve social problems by giving generalised ideas a basis of logic and probability. The Dainton report is undoubtedly right to ask for new approaches to give science, too, a renewed relevance to human and social problems as the younger generation sees them.

To the school children of this country it appears that science and technology have already solved most of our daily problems. The struggle is not to design an atomic power station but to persuade the miners' leaders to agree to its being constructed. The understanding of genetic structure is mentioned in the report as a matter of great interest and importance: even more important before long will be the political decision to use or not to use it to 'improve' the human race. As our civilisation is arranged at present the decision will be made by a non-scientist; but perhaps by the time the decision has to be made we shall have produced so many scientists that many of them will be able to take a leading part in public life outside their specialisms.

There is little curiosity about science: so much is now established fact. Techniques of science have become too careful to be exciting. Experiment is prolonged and discoveries appear remote from daily life or are applied in ways which threaten humanity. In the past the money spent on scientific research was abundantly returned in the satisfaction of basic human needs, but now our society appears unable to afford the expense of research and still less the cost of applying such inventions as the linear-induction motor or the kidney machine. Even education committes have been known to question the cost of providing special laboratories, expensive equipment, services, apparatus and ever-changing textbooks, and of recruiting rare graduates of science and even rarer laboratory technicians.

One of the report's recommendations is to delay the choice of science. If so, we must also delay other choices. We then find ourselves continuing about fifteen subjects until the fifth year, each with about two periods a week, in order to keep open all choices until the sixth form; alternatively we can decide on some arbitrary but balanced course such as English language, English literature, French, Latin, history, mathematics, physics and chemistry which offers the choice of two standard four-subject groups in the sixth form but involves the rejection of music, art, religious knowledge, German, domestic science, technical subjects, biology and geography as possible A-level subjects. Such deferment of choice would not, as is claimed in chapter VIII, provide us with a larger reservoir. On the contrary it would dry up the springs of individuality and lead to a parched and barren sixth form. If decisions for or against science, engineering and technology are to be still further deferred until the end of the sixth form, there would be a general and severe lowering of standards in every

subject, including science. A temporary shortage of science undergraduates could not be held to justify such sweeping changes.

Twenty years ago the general school certificate with its matriculation requirement imposed a rigid pattern on studies up to O-level, and the higher school certificate offered standard groups in the sixth form. Those were the days of 'premature withdrawal' one or two years *before* O-level. With the coming of GCE as a subject examination, some freedom of choice became common for pupils from the fourth form onwards. Even among the top 30 per cent from whom my pupils are drawn there are always a few who cannot face the continuance of French or mathematics but who are nevertheless of university potential if I do not crack their spirit at the age of fourteen-and-a-half. Forbearance produces a fifth year of 91 from which 87 boys and girls will stay for three-subject or four-subject courses in the sixth form. About seventy will continue to university or further education. Some, regrettably, will not have taken O-level mathematics or will be slightly deficient in some other way but it is primarily the quality of their specialism that matters. As I now prepare to receive fourth year pupils from a modern school, I find myself even more willing to accept a degree of imbalance in their courses, in return for the hope of developing some related group of specialist subjects. If we are to enlarge our reservoir of talent we must welcome the gifted mathematician who is not particularly literate and is completely beaten by a foreign language. Conversely we must not prevent the emergence of a gift for languages or a love of literature by insisting that it must be accompanied by success in sixth form mathematics.

It is harder for a sixth former of moderate ability to take a coherent course of science than to take a meaningful combination of other subjects. Without mathematics, physics is impossible; chemistry needs the support of physics and some mathematics; biology is becoming increasingly dependent on mathematics as well as chemistry and physics. Although these subjects are interdependent they do not require the same basic abilities nor do they call forth similar interests. The girl who is attracted by the living quality of biology will not find the same satisfaction in mathematics, physics and chemistry. The boy who loves the logic of mathematics may dislike the practical work of science. Furthermore, each of these subjects tends to be taught as a pyramid of knowledge. Progress in science becomes difficult if the pupil has failed to understand valency, or has been absent when logarithms were explained, or wishes to change to science from specialisation in arts.

On the arts and social side, history, geography, economics, English literature, music, art, religious knowledge and a foreign language do not have this same degree of interdependence. One can study any combination of two or three of these subjects even though one dislikes, or is ineffective in, the rest. For this reason, as we include more of the ability range in our enlarged sixth forms we are likely to have an increasing proportion in the social, arts and mixed categories. Knowing the qualities and limitations of the boys and girls in the all-purpose sixth forms which are being developed, I do not consider it unreasonable that only a third of the pupils should be specialising exclusively in science. The report correctly notes that the quality of the science group has tended to be higher than that of other groups

and, as more than half of the university entrants are on the science side, it is at least arguable that the schools are making a reasonable division of their pupils.

It seems strange that in a report dealing with technology there should be so few references to technical studies in schools. In many boys' modern schools—and in a few grammar schools—the technical rooms are the heart of the school, receiving from and giving to science, art, mathematics and geography. In the change to comprehensive schools, many of us hope that this mainly modern school outlook will become common for the whole ability range. At present, universities and their engineering departments show no interest in school technical studies even to the point of refusing to recognise O- and A-level passes in technical subjects. While this is so, many schools will keep their possible university entrants away from technical subjects. In due course these students will show preference for pure science, rather than technology, and will contribute to the country's general belief that engineers are inferior to pure scientists. The Page report should be read to correct this view.

Chapter III, though critical of the teaching environment, seems optimistic to heads who are now wrestling with problems of staffing and equipment. The explanation is that it is based on the position up to November 1965. When I addressed meetings of university mathematics students in 1966 in an attempt to interest them in teaching, I found them reluctant to contemplate teaching a complete ability range. They did, however, agree that a mathematician could find satisfaction as a headmaster dealing with the complicated organisation of a large comprehensive school. At one university only one mathematics student attended the meeting which I had travelled a hundred miles to address. Enquiry now from institutes of education and colleges of education would indicate whether science, mathematics and engineering students are being recruited in sufficient numbers. Table 6 of the report shows that the entry to colleges of education gives cause for concern.

It would be valuable to check the impression of some professors that there are now only a relatively small number of maintained secondary schools which produce a regular supply of well-trained mathematicians and scientists. Figures for successful schools might be obtained from UCCA or from GCE examining boards. A school which has weakness in even one of the four departments of mathematics and science soon begins to handicap all its science candidates. Table 18 of the report shows that schools concentrate their best qualified science and mathematics staff on sixth form teaching but nowhere can a weak teacher of science or mathematics be safely hidden. In schemes of reorganisation, recommendation 185 might be implemented by making special efforts to keep intact for some years the existing centres of uniformly good scientific teaching to produce students for the universities and to serve as centres helping teachers from neighbouring schools. All schools might thus be enabled eventually to have good teams able to extend the sources and the supply of science students ready to enter further education.

Is there a link between the Schools Council report on the classics and the humanities and the Dainton report on science and technology? Is there a new curricular field waiting to be opened up?

Dainton and the Classicists

NOEL COWEN

There are times when the education service shows a curious resemblance to Archimedes in his bath. Two trains of thought converge, each unaware of the other, then suddenly . . . *eureka!*

An unlikely and unobserved conjunction of this kind occurred at the turn of 1967-68. In December came a modest little paper from the Schools Council called *An approach through classics*, one of the series about humanities for the young school leaver. The authors had been looking for courses suitable for children of a wide range of intelligence below the age of fifteen, courses which—while arising from the classics—'would be much wider than the traditional study of Latin, Greek and ancient history.' Then a month or so later came the report of the Dainton committee, concerned not with the classics but with science and technology, not with a wide range of intelligence but with prospective entrants to higher education.

The report on the classics very fairly admitted that the courses it put forward might leave some people dissatisfied: in particular some 'might feel that more mention should have been made of science, mathematics and technology.' After all, the ancient world could 'illustrate clearly the influence upon civilisation of discoveries made in these fields: for example social changes brought about by the invention of iron weapons, writing and coinage; or the importance of roads, concrete, drainage and cargo ships.'

'Such things,' the classicists conceded, 'could well be organised into a course similar to the ones printed in this paper. It is all a matter of choice and enthusiasm.' And there—somewhat tantalisingly—they left it.

Meanwhile there was the Dainton Committee. Their problem was the deficiency not of humanists but of scientists and technologists, and one of their remedies was that 'engineering, technology and science must be made more attractive throughout the whole of education,' above all to the able but uncommitted student. The scientific signatories of the report then gave us the same sort of throwaway line as the classicists: 'There may be an element of subconscious revulsion from the forces which scientific progress makes available, and the large moral and social issues which the control of those forces raises.'

Somewhere between these two (almost apologetic) suggestions is there a *eureka* waiting to be born?

One might begin by looking at that challenge thrown down by the classicists. What in fact were 'the social changes' brought about by

the invention of iron weapons, writing, coinage, and roads? And did they raise any 'large moral issues' of the kind that Dr. Dainton and his colleagues see involved today in our subconscious attitudes to scientific progress?

The main consequence for man's social organisation of this particular group of technological innovations was that an imperial society became a technical possibility: that is to say, men could belong simultaneously to a local community and to a larger network of linked communities. Cheap iron provided the material base, but the crucial discoveries were the alphabet, a stamped coinage, and a system of roads leading to and from the capital. The first allowed an imperialist monarch to communicate freely with a variety of subject peoples, the second allowed him to trade with them and tax them, and the third allowed him to send armies and administrators to control them. These three innovations appeared more or less together and wherever they did so an imperial society in the grand manner followed: the Persian empire from Egypt to Russia and the Punjab, the Roman empire from the Nile to the Thames, the Mauryan over most of India and the Han from the Pacific to central Asia.

This transformation of man's social rights and obligations was undoubtedly accompanied by what the Dainton Committee has called 'large moral issues.' So much so that in the four areas in which this technological progress was carried through there occurred also spiritual adjustments of so great an intensity that we are still involved in them: changes associated with Zoroaster and the Jewish prophets, Buddha and Confucius, Plato and Jesus.

It was surely no coincidence that the profound moral issues formulated by these men arose within the historical framework of emerging imperial societies. The spiritual innovation underlying them all was to subsume local territorial cults within a religious framework acceptable anywhere. Men who found themselves belonging politically both to a local and an imperial society would be more likely, to put it no higher, to see sense and significance in the concept of a wider spiritual society.

What historians and technologists and teachers of RE might be expected to find interesting is the seeming close link between technological progress, political change and religious belief. Designers of curricula might find here a promising line of thought.

Nor need they stop at the period that interests the classicists. They can turn to the sort of technology that Dr. Dainton and his colleagues had in mind—the sort that has to do with machines and mechanical ways of doing things. The foundations of European supremacy in this kind of technology were laid in the centuries before and after 1000 AD when a variety of devices were brought back from the East by traders, pilgrims and crusaders: the mould-board plough and the padded horse collar, wind and water mills, the lateen sail and the sternpost rudder, Arabic numbers, artillery fired by gunpowder, and finally the printing press.

The social and political consequences were that Western Europeans created new wealth and began to explore the seaways of the world. Better ploughing produced a surplus of food and a surplus of energy. Improved power stimulated textile manufacture, mining and metallurgy. To make and service the new contrivances a new class of

mechanics was called into being. Galileo employed them to make instruments to scan the skies and began to apply mechanical principles to all forms of matter.

Modern history of course is about the social and political sequel to this mechanical revolution in Western Europe; and children who leave school without grasping that fact are poorly served. But the matter does not end there. The advance of the Atlantic nation-states into world dominance also produced some 'large moral issues' (and still does) which have curricular possibilities extending from technology to political theory and personal faith.

After Galileo men thought increasingly in terms of machines, of a mechanical universe, of a society in which forces had to be held in equilibrium by checks and balances and colliding nation-states by a balance of power. Man had arrived at the mechanistic world-view, illustrated as much by Harvey's discovery of the circulation of the blood as by Newton's *Mathematical principles of natural philosophy* or Hobbes' *Leviathan*.

So if our fifth and sixth formers are really scared, as the Dainton report suggests they might be, of the consequences of twentieth century technology they had better start facing two facts: the first is that technological transformation of human society is nothing new; and the second is that in past periods of comparable advance our forbears showed remarkable capacity to adjust their political and moral thinking. If we refuse to do the same we shall be trying to opt out of history.

Just to round out the historical perspective we could swing the arc still further back—not 400 years, to the birth of the nation-states, not 2,000 years to the land empires of antiquity, but 6,000 to the birth of civilisation itself. Surely man recoiled a little from the effrontery of that immense creative act! Well yes, in those millennia also there were profound restatements, in the Middle East and the Far East, of human ideas about creation, natural forces, and the way men ought to behave in their corporate affairs. Today we refer to these restatements, in disparaging terms, as myths. Their underlying concept was harmonious relationship, and we see in this man's anxiety to safeguard his future, political as well as ecological.

The myths of the ancient societies of Egypt, Mesopotamia, India and China were among the most heroic intellectual undertakings of all time. And they too were the end-product of a technological revolution: the invention of settled farming, pottery and weaving. Was this any less a 'force for progress' than the scientific revolutions now supposed to be giving our abler teenagers a loss of nerve?

Contemporary advances in science and technology are undoubtedly of the same order as those which shook mankind 6,000 and 2,000 years ago, and which shook Western Europe 400 years ago. They are already transforming the world political situation, as the earlier ones did, and will make inevitable a new assessment of man's understanding of his place in the universe. The lesson of history is that this is likely to be sought within the terms of the technology rather than by running away from it.

'In spite of the obvious difficulties, it is surely worthwhile for schools to experiment with different social studies programmes. In terms of sheer content it is undoubtedly more important to provide young people with an understanding of their social environment than to bore them with "Napoleon and some battle." '

Changeover to Social Studies

D. B. HEATER

Three years ago the doyen of history teachers, Miss Dorothy Dymond, in an address to a meeting of college of education lecturers, sadly announced her belief that during the half-century that had elapsed since she wrote her first article on the teaching of history, the subject had made less progress in terms of syllabus content and teaching methods than any other subject in the curriculum. It was consequently, she argued, in danger of being displaced by the more vigorous social studies. There can be little doubt that the battle is joined, and each side has valiant and powerful battalions. But each side is so busy defending its own position that it is sometimes difficult to discern the really fundamental issues that should weigh with the waverers in deciding which camp to support. This article is an attempt to elucidate these issues.

If history (and geography) is to be replaced by or subsumed under social studies, two main benefits are expected to accrue. In the first place, a social studies syllabus will be focussed on the study of the contemporary society of which the pupils are members and in which, as they grow older, they must take on increasing responsibilities. Thus social studies can be expected to have both a higher interest-value and more direct utility than traditional history and perhaps even than contemporary history, which is being used by many to give the old subject a renovated appearance. And since 'relevance' is the important new keyword for assessing secondary-school curricula, these are vital considerations. The other expected gain from the introduction of social studies into a school syllabus is the opportunity they provide for an interdisciplinary approach to study and the destruction of what are conceived to be the artificial barriers that traditional subject divisions raise to hinder the natural pursuit of intellectual interests. It is this second factor of the supposed value of integrated study that is particularly at issue and upon which I should therefore like to concentrate here.

The question of the value of integrated study as against the study of separate disciplines may be viewed as nothing more than the revival of the basic problem facing anyone undertaking the construction of a school syllabus, namely how to balance the logical requirements peculiar to the structure of each subject and the psychological restrictions of the pupils' interests and abilities. Generally speaking those who think philosophically are concerned essentially with the unique

contribution any subject can make to a young person's education, while the psychologists' attention is focussed on the fact that when children's interests are stimulated by the study of topics or problems, the frontiers between the disciplines are ignored. Let us look at these two positions a little more deeply.

Professor Paul Hirst has been particularly prominent in recent years in attempting to identify what one might call 'the primary subject,' which have autonomous structures, which cannot be analysed down into agglomerations of other subjects, and which must all therefore be active constituents in a well-balanced educational programme. Several years ago W. H. Burston of the London Institute of Education addressed himself to the problem in the pamphet *Social Studies and the History Teacher*. One of the points of criticism he had for social studies was precisely the point that if a number of subjects are amalgamated into a social studies syllabus, their logical structures are subordinated to the over all pattern of the integrated syllabus, which, in its turn, will be in danger of lacking any coherent thought-structure at all. The philosopher's position is, then, briefly, that the traditional disciplines, far from being fortuitous delineations of human knowledge, each represent unique perspectives to understanding, which we can discard only at the peril of impoverishing our educational programme.

The 'psychological' argument is perhaps most obviously represented by the Nuffield feasibility study on an integrated humanities curriculum and by recent official publications such as the Newsom report and the working papers of the Schools Council, particularly No. 2 and No. 11 on the raising of the school-leaving age. It is true that reservations are made—history and geography are still referred to in places as separate subjects or separate components in a programme. Yet the whole emphasis is on the integrated topic approach: this is particularly evident in Working Paper No. 11, *Society and the Young School Leaver*. Descriptions of work seen in schools and suggestions for suitable 'areas of enquiry' are all based on this pattern. One example provides for the study of the child, his development, home and life in society. It is difficult to form a very accurate idea from a syllabus precisely how such a course would develop (one wonders, for example, about the significance of the entry '*Lecture 3:* Conception and birth . . . by senior mistress (mother of two children). Supporting and preparatory work by director of studies!'). It is nevertheless clear that history, geography, biology, sociology and politics—with some mathematics and English—are all involved as contributory methods of investigation and presentation. It is clear too that such a course is likely to appear interesting and significant to the majority of young people and therefore likely to stimulate them into positive enquiry and learning.

Identifiable Disciplines

In their 'pure' forms evidently both the subject and the topic approach to study suffer from limitations: the subject approach may be too divorced from reality as seen by the non-academically-minded child, while the topic approach fails to provide systematic training in any given mode of thinking. Extra impetus has recently been afforded to curriculum reform along lines that many believe would circumvent these difficulties. This impetus derives largely from the ideas put

forward by Professor Jerome Bruner in *The Process of Education*, a report of the deliberations of a number of senior American academics. Although he is a psychologist, Bruner is arguing the philosophers' case for identifiable disciplines. Bruner's committee were particularly concerned that a student should be able to make the most effective use of every stage of learning by being enabled to relate earlier to later material. This can best be achieved, it is argued, by constructing a syllabus in any subject in a spiral fashion, so that the basic elements of the subject are repeated at advancing levels of sophistication as the student progresses through his course. In this way, data are more easily assimilated because they are perceived not in isolation but as comprehensible parts of a conceptual pattern. An example from Bruner may clarify this argument: 'Once one has grasped the fundamental idea that a nation must trade in order to live, then such a presumably special phenomenon as the triangular trade of the American colonies becomes altogether simpler to understand as something more than commerce in molasses, sugar cane, rum, and slaves in an atmosphere of violation of British trade regulations.' An essential preliminary to such an exercise must inevitably be the identification of these basic elements or 'structure' of each subject. Moreover, if the deliberate construction of a syllabus round this identified structure is so important for effective teaching, it is clear that an integrated social studies programme is virtually impossible to achieve, since the essentially different structures of economics, geography, sociology and so forth require separate articulation. The implications of these ideas for social studies programmes in English schools are being worked out by Messrs Entwistle and Lee of the University of Manchester, who have argued forcibly (in *The Times Educational Supplement*, 8 July, 1966) against any attempt to force disparate traditional subjects like English, R.E., history and geography into uneasy partnership, but rather that the essential principles of the true social sciences (such as economics, sociology and politics) should be identified and organized into an inter-related (though not integrated) curriculum. Investigations of this kind are already under way in the USA and may be found conveniently summarised in E. Fenton, *Teaching the New Social Studies in Secondary Schools: An Inductive Approach* (Holt, Rinehart and Winston, 1966).

Whatever approach one uses to introduce social studies into the secondary school curriculum, no one would pretend that the task is easy. Firstly, there is the sad memory of the post-war experiments that were inaugurated with the secondary modern schools. Secondly, the well-established courses in history and geography are entrenched by well-defined CSE and GCE syllabuses. Thirdly, there is the problem of achieving any coherence in a social studies programme, whether of the 'Newsom-humanities' kind or of the 'Entwistle-social science' kind. For once one starts to identify the elements that should constitute such a programme, an immediate snowballing effect takes place. In the one case one starts with history and geography, but English, RE, civics and even mathematics and biology may steadily be accumulated. If on the other hand, one starts to build a strictly social science syllabus, there are quickly added to the basic sociology and economics—politics, law, psychology and anthropology. Having embarked on the exercise of bringing different disciplines into close relation with each other, it is difficult to justify any stopping point

short of an all-embracing programme, yet such a programme needs very careful handling if it is not to become unwieldy or fragmented. One may wonder therefore whether there are a sufficient number of teachers available to undertake such difficult experiments with confidence. Training institutions have hardly begun to face the implications of the above arguments either in their initial or their in-service courses, even though an increasing number of social science graduates are being produced by the universities.

Need to Experiment

Yet in spite of the obvious difficulties, it is surely worthwhile for schools to experiment with different social studies programmes. In terms of sheer content it is undoubtedly more important to provide young people with an understanding of their social environment than to bore them with 'Napoleon and some battle' (Peter Willmott). Moreover, in terms of organization of material also experiment is justifiable. There is parallel work in other spheres to suggest that the bringing of different subjects into combination is fruitful. Topic work or centres of interest are well-established features in the primary school time-table; while in the natural and mathematical sciences at every level of study the tendency is to pose problems and draw upon the relevant explanatory models (chemistry or physics, algebra or geometry) to aid in the solution. In the same way in the social sciences one might wish to study the present pattern of taxation in this country, for example. One would then call upon history, politics and economics to explain this configuration.

Experiment is always necessary to prevent stagnation. It is essential, however, that not every teacher and institution be whisked along without sufficient thought into a new convention of organizing teaching material. Integrated study is now the fashion at primary, Newsom and university level. The grammar schools are becoming steadily more isolated in their curricular conservatism. Their courses, epitomised and determined by O-level requirements are suffering mounting criticism. And yet they do provide their pupils with an introduction to the distinct modes of thinking and explanation as represented by the various disciplines. And has anyone fully imagined an educational system shaped in its entirety by the organizational requirements of interdisciplinary study? If social studies are universally adopted in place of the more traditional single-subject studies, we shall find ourselves a major step forward in that direction. The desirability of such a step needs widespread discussion.

This article continues the Trends *series on the work of colleges of education.*

Teachers and the History of Education

DAVID HOPKINSON

Nicholas Nickleby recognised his lack of qualification for a teaching post at a school in Yorkshire (annual salary £5). But his employer was satisfied by the fact of his being a gentleman and the son of a gentleman. That state of being constituted one avenue of entry to teaching in the nineteenth century. The only alternative open to those who were not gentlemen was apprenticeship.

In Scotland progress towards the recognition of teaching as a learned profession with entry qualifications involving some specialist study came more quickly. The earliest chairs of education in Britain were instituted at Scottish universities to promote teaching of the theory, history and practice of education. Later, in London and then at Oxford, the first examinations for a teaching diploma were in the theory and history of education. Historically the place of history in the study of education was thus central. It remains the normal practice to incorporate educational history into courses of study designed for those who are intending to become teachers. Is this practice still justifiable? In education generally relics of the past have constantly to be discarded and new subjects introduced. A law of jettison and replenishment must apply equally in the specific context of teacher training. On this assumption it becomes clear that arguments intended to justify the place of educational history must have contemporary and not historic foundations.

In the past those who sought to give to teaching the status of a learned profession looked naturally to what had happened in the development of other learned professions. If teachers were to be trained in the same manner as lawyers, clergymen or doctors, then something specific to the profession itself must be set up for them to study. 'A true profession implies a mystery,' wrote Frank Roscoe, first secretary of the Teachers' Registration Council, an organisation once of importance to the status of teachers. It must have been observed that respect to a profession, as to a family or a nation, was in some degree accorded in proportion to the duration and consequence of its history as well as to the social function it performed and that some historical elements were incorporated in the studies of those seeking to enter the Church or diplomacy or the armed forces. A history of education was needed and a history of education had accordingly to be produced. Histories created in such circumstances may, like the history of cavalry regiments in the British Army, outlast their usefulness. Church education, dissenting education and state education all have a regimental history. In some degree acquaintance with the development of modern mass education through the commissions, the legislation and the orders in council of the nineteenth century is perhaps worth the attention of a contemporary teacher. What was thought and done by the men who influenced educational development may also be held to exert a claim,

but this would seem to require that the student teachers possessed sufficient historical background and imagination to interpret such messages by reference to the circumstances in which they were delivered.

Half a century ago it was being argued that history in training colleges should not mean 'the biographies of great educators, but a knowledge of what has been suggested or attempted in the past.' The retort to this proposal is of course that teachers are not going to operate in the past but in the future. Such an assertion would no doubt be countered by the claim that historical knowledge enables us to estimate the merit of new proposals and to distinguish between those that are useful and practicable and those which are ill-judged and deceptively plausible. Common sense might here serve us just as well.

It is not the value of historical knowledge but of historical understanding that one might choose to emphasise to-day. What is it then that those who are going to teach may be expected to gain from the history of education?

Historians are people equipped to create life studies that delineate the world around us and the men, women and children that people it. The life studies made by a graphic artist differ from a historian's in two respects. Many such studies will consist of lines drawn on an otherwise blank paper and will represent the nude figure. Life studies of this kind are not history because they contain nothing that attaches the study to space or time. The historian's pictures must be as exactly related to a specific point in space and to a specific moment of time as would the sociologists or the econometricians. Secondly the historians' picture, to use Collingwood's words, 'stands in a peculiar relation to something called evidence.' No historian would claim possession of all the evidence bearing on a situation which he has chosen to describe, but no historian would describe any situation at all unless he had *some* evidence to produce. Optimistic historians like E. H. Carr believe that the function of the historian is to master and understand the past as the key to the understanding of the present. Accordingly they must believe that evidence faithfully descriptive of the past can be found if only historians are talented and industrious enough; or if it cannot be found *now* then that it *will* be found at some point in the future. A pessimistic historian—Sir Lewis Namier for example—believed that the beneficial therapeutic effects of history have so far been small. Nevertheless Namier thought that the study of history was valuable, provided it penetrated deeply enough, excavating sufficiently substantial quantities of evidence, and was uncontaminated by any moral, social or political purpose.

Thought and Action

To think of history as a collection of pictures, or as the thought of the past re-enacted in the mind of the historian, as Collingwood did, is open to one considerable objection. History itself may be both thought and action but the medium through which the results of historical study are transmitted can only be the medium of words. Both history—as something distinct from an historical object—and the writing of history depend on narrative. The historian must first learn to read and then, as Professor Gallie has pointed out, to acquire the expert kind of

understanding required by someone who reads a narrative for the purpose of assimilating the thought embodied in it. 'Historical understanding,' Gallie has written, 'is the exercise of the capacity to follow a story where the story is known to be based on evidence and is put forward as a sincere effort to get at *the* story so far as the evidence and the writer's general knowledge and intelligence allow.' To question the historian's judgement and to criticise his narrative is the only way to recognise his function—that of providing a credible account of his material.

It is not suggested that the teacher must be a historian or indeed possessed of any great knowledge of history. What is important is that all who teach should have had some experience, and therefore some training, in the application of critical attention to a story, distinguished from other stories in two respects—its pretensions to be a true story and its relevance to the task on which a teacher will be engaged.

The teacher is a functionary within (according to the observer's angle of vision) the system of social welfare provision or the programme of capital investment which his society has initiated. To every such function there is a historical dimension and to teaching this is perhaps especially marked. If this is so the reason probably lies in its antiquity. Teaching began in the first human family.

There is a 'mystery,' to put it at its mildest, about children and about the relationship of parent to child. It seems difficult for the parent not to love his child, however horrible the child's behaviour, and almost as difficult for the teacher not to want success for his pupils, however undeserving of success he knows the pupil to be. The evidence for these statements is historical evidence. An historical understanding may help a teacher to form a picture of what he is and what he is doing. It may relieve his isolation by reason of its power to indicate the organic relationship between what he does and what others have done. The function of the teacher is inexplicable without historical thinking. He is in the classroom because events which have occurred in the past happen to have placed him there: they are events in his personal history, events in the social history of his society. In the classroom he teaches in accordance with principles or methods or practices most of which he has acquired. Only historical understanding—that is his capacity to follow the story of the history of teaching—can give him an insight into the task he performs.

No one is going to dispute the importance of understanding the society in which the process of education takes place; this is only one degree less important than the nature of the material, children and adolescents, with which the teacher has to deal. Anything that throws a light on child development the psychology and the learning processes of pupils obviously demands consideration in a teacher training programme. It can also be affirmed that increased knowledge of the social forces influencing the outlook and response of pupils is one way by which methods of teaching can be refined and their impact sharpened. The psychologist, for more than fifty years, and the sociologist in the last five or six have rightly been important influences in the training of teachers, but the influence of the historian has not therefore become obsolete or redundant. Indeed the teacher, who has to act and suffer in a situation partly governed by historical forces outside his own control, especially needs an understanding of what others did,

facing the same task as himself, yesterday and the day before. By the exercise of historical understanding a student may discover that the practice of teaching has an identity separate from his own teaching practice. He may learn to understand what he is doing because of the relationship it bears to what others did, Socrates, Thomas Day or Mr. Squeers for instance. The history of art does not mean the history of the Arts Council, so the history of education is not primarily the history of educational policy or administration but the history of teaching.

The teacher who enters a classroom for the first time, like the sculptor who raises his chisel to a fresh stone, is as free to create living forms as he is to destroy, pervert or mutilate the material with which he has to work. The factors that govern the teacher's freedom are historical and psychological. Those elements in the classroom situation which have social and psychological overtones are not difficult to identify. We may have ceased to talk, like Oscar Wilde, about the Soul of Man under Socialism (or the Soul of the Child in the Comprehensive School), but crudely we recognise that each child has a psyche inside him and that his response and behaviour is conditioned by the culture from which he is sprung. The co-ordinates of culture are historical as well as contemporary. The history of teaching is a narrative of cultural development and to the extent that the sociologist promotes understanding of cultural conditions and their results, his value to teachers is self-evident.

Grasp of Realities

In the training situation the important thing is that the sociologist and the historian should work together. Their first task is to provide the young teacher with a grasp of realities that comes from questioning common assumptions about the terrain on which the educational struggle takes place and about the equipment of the combatants. Those who theorise about education may see these combatants as great social forces. 'Education can only be understood when we know for what society and for what social position the pupils are being educated,' wrote Karl Mannheim. In the history of education we should, according to recent advice from Professor Simon, concentrate 'on those broad movements which have affected the majority of people and essentially constitute the educational history of the nation.' All this is great stuff for the professors, but for the ordinary teacher the combatants are not broad movements but he himself, on the one side, and his pupils on the other. His job is to make in-roads on their ignorance and by tactics, which may be blunt or subtle, to manoeuvre them into contact with the human achievement of the past. This is equally true whether he teaches reading or mathematical notation or nuclear physics. The value to him of an historical understanding of the educational situation will lie in his imaginative insight into the outlook and behaviour of his pupils. It is on this that his relationship with them will be based and it is on the quality of that relationship that his success will depend.

Anyone who has studied the work of teachers in the classroom must have been impressed by the unpredictability of its success or failure. In a teaching situation the problems and difficulties that will arise cannot all be foreseen. Anxiety and lack of preparation are obvious

causes of failure in teaching, but confidence and preparation do not guarantee success. To possess imagination and mental flexibility often appear to be the teacher's greatest assets. These are qualities which may possibly be intensified by a study of history and of literature. Certainly a serious attempt to acquire some degree of historical understanding of the operation in which one is involved, whether it be politics or navigation or teaching is likely to enhance one's capacity to operate with flexibility of mind and with imaginative insight. Teachers used once simply to teach, often within sight and sound of others more experienced than themselves, in the same way that runners used simply to run, covering 100 yards, perhaps, for a wager of 50 guineas in a time of 12 seconds. In the year of the Olympiad in Mexico it is necessary not only to train the body, but to study the properties of the air through which it has to be propelled. Similarly the training of a modern teacher rightly demands the study of children and of society, but these studies by themselves are no guarantee of success. The Olympic champions will possess certain qualities of tactical judgement and resourcefulness which the teacher also needs.

A teacher is not an operative slotted into a classroom to perform a prescribed task. His rôle is more analagous to that of a film director, given a script, a cast and a location, and free to manoeuvre subject only to human and logistical limitations. His training should resemble that of a creative artist which necessarily contains a large element of self-training. The artist, architect, musician or designer prepares himself by a study of the past. He demands to know what has happened in painting or architecture or music, like a spectator who arrives at half-time and wants to know the score in a football match. Inevitably he acquaints himself with the endeavour and achievement of those who have faced problems similar to his own. He knows what they did and searches for an explanation of why and how they did it. Some of his predecessors he will love and some he will probably hate. They will have become, as it were, his near relations. History is a dimension without which neither the arts nor the sciences can be adequately described. It is, to use Professor Oakshott's phrase, a voice becoming audible in the conversation of mankind. The teacher, whatever the subject matter he seeks to impart, will be well-advised to listen to it.

This article is based on a survey carried out by a team of H.M. Inspectors in several groups of schools in the north of England. The purpose of the enquiry was to throw light on the quality of care for children in ordinary schools who have educational difficulties. An educational psychologist, working for an authority in another part of the country, contributes a commentary.

Continuity of Care

J. R. FISH

Many children, attending primary and secondary schools, need extra help to overcome a variety of learning difficulties and to make reasonable progress. The range of problems has been discussed fully in other contexts, for example in Chapter 21 of the Plowden report. Less appears to be known about the kind of assistance teachers may require in order to understand and help these children within the ordinary school. As children pass from teacher to teacher and from school to school a particular problem arises: how can continuity of care and education be achieved.

In a series of visits to schools, teachers were asked which children caused them concern and why. A number of ways of providing extra help were observed and discussed with those concerned. There was naturally some variation in what was thought necessary, what was attempted and what could be achieved. It was abundantly clear that teachers welcomed an opportunity to discuss children in their care, particularly those with difficulties, and they had much to say about the kind of help that they would value.

The size of the group of children who may need additional help is only now becoming appreciated. The one or two children in any class or the small number in the individual school may seem to present no compelling case for special action. When, however, the numbers, in each area, are added together, the totals become impressive; about ten per cent of the school population in one area, fourteen per cent in another, sixteen per cent in a third. There was no evidence that many of these children needed education in special schools. The figures are consistent with those quoted in the National Child Development Study where it was found that thirteen per cent of seven-year-olds were receiving some form of extra help or were thought by their teachers to need it.

In primary schools, almost all children were in mixed ability classes. As a result there were few, if any, teachers not directly involved with children with learning difficulties. Awareness of causation and of the effects of different handicaps varied. In the infants' school the child-centred atmosphere often led naturally to the identification of children who might be educationally 'at risk.' Junior school teachers tended to

be more preoccupied with skills, particularly proficiency in reading. A range of problems tended to be included under the heading of 'children who could not read,' and solutions tended to be envisaged in terms of appropriate material and method. Secondary schools, with their greater complexity of organisation, tended to group together children who have been relatively unsuccessful. Fewer teachers were directly involved but the tendency to see children's difficulties in terms of what they could *not* do was no less notable.

Problems appeared to include various combinations of backwardness, retardation, mild physical handicap, maladjustment and social deprivation. Teachers had no easy way to get appropriate advice and guidance to help them to formulate more precisely the real difficulties of the individual, and there were few specially trained teachers to initiate specific courses of action.

By far the most common approach to all difficulties in primary schools was the withdrawal of groups of children for extra help in reading. Groups were taught by head-teachers, and, in some cases, by part-time teachers specially appointed for the task. Three characteristics of this work militated against its effectiveness. It was often intermittent and irregular as other duties and minor crises in the community took the time of the head-teacher; where additional teachers were involved, groups were usually the first to be disbanded at times of staff illness, or absence on other duties, with the result that continuity was difficult to achieve. Children in this category also suffered from the detrimental effects of frequent staff changes which seemed to occur more frequently where less successful children were concerned. Secondly, the concept of remedial education tended to be narrowly conceived as improving mechanical proficiency in reading, with the result that children were following a reading scheme or concentrating on technique to the exclusion of a wider range of relevant activities and necessary experiences. Finally, this work was not always related to the child's daily life in his ordinary class. There was little evidence that the work of part-time groups was planned to fit in with ordinary class activities. For example, with one group of children, two different approaches to reading and writing were observed, one in the class and the other in the remedial group. Books and materials for younger children were usually adequate, but for the older, weak reader the supply was more limited.

Two junior schools had initiated special classes. One posed interesting problems of continuity by being the only class in the school or associated infant schools to use the Initial Teaching Alphabet. One of the authority's centres for remedial education was situated in one area, but it could only cater for a very small number of children from the schools concerned. There were no other forms of provision in any of the areas on a day basis, either full-time or part-time, to which children might go for more intensive educational help than was available in the local school.

At the secondary stage children usually found themselves in lower streams where there was somewhat less subject specialisation. Some special classes existed and, in one school, groups were withdrawn for extra help in basic subjects from an unstreamed bottom half of the ability range. There was only one instance of extra tuition in groups smaller than a whole form. Unless the individual was so backward as to be placed in one of the lowest stream classes, it was increasingly

difficult to find any one person who had an oversight of a child's whole development and who could provide care and help other than at times of personal crisis when the most senior members of staff became involved.

Continuous Help

Of particular interest was the extent to which efforts to help children in need were continuous over their whole school life and beyond. Continuity is necessary not only within schools, but also between schools and in relation to other social agencies. One basis on which continuity may be developed is an adequate record of individual progress. Some records were very complete and comprehensive, particularly in infants' schools and with vertically grouped classes. Records tended for many reasons to remain within the particular school and only limited extracts were passed from school to school. This was perhaps because too much emphasis was placed on information about the home background and difficult behaviour, and too little on the child's performance in school and on an analysis of his learning difficulties. Samples of work were not often collected systematically. It seems necessary to consider what additional information and necessary evidence should be collected about children 'at risk' educationally so that attempts to help them from year to year can be based on more precise knowledge of previous educational experience.

There were particular instances of very good continuous contacts between schools, both between individual infant and junior schools and between a secondary school and contributing primary schools. The general situation, however, suggested that not enough was being done to forge permanent links between groups of schools either in relation to general knowledge of each other's work or in relation to groups of children presenting particular problems.

It became clear that many teachers would welcome the further education and training which would enable them to tackle the more difficult problems in their classes and make proper use of the services available. In many instances they were not adequately informed about the existing resources or about the potential educational handicaps of many disabilities. Newly appointed head-teachers are a particular group of people who need some guidance as, under present circumstances, they may have had little previous contact with medical, social and educational welfare services. Secondly, part-time work with a group of backward children is, in many instances, the first work undertaken by a married woman returning to teaching. Her commitments have made it difficult for her to keep abreast of current developments and may prevent her from attending centrally arranged courses. Some more specific help is necessary with regard to books and methods. Finally, a large number of newly qualified teachers, particularly in primary schools, are going to be faced with a mixed ability class. The increased pressure to abandon streaming carries with it the responsibility to provide adequate help, both for these teachers and for those children who may need it.

No specific gaps in the social and welfare services were mentioned by teachers. The education welfare officer and the school nurse were quoted as giving invaluable assistance. There was some reluctance to

refer children to other agencies, such as the school medical officer or education psychologist since this might be assumed to imply that the school had failed and the child should be helped elsewhere. It was sometimes said that little was learned about the child once attendance at clinics, courts or probation offices began, and general concern was expressed about poor communications with other agencies and of a limited feed-back of information from them to schools.

The value of visits by school medical officers, educational psychologists and other advisors was stressed by a number of schools. Some teachers would welcome peripatetic remedial teachers, others more help with speech problems. There appeared to be few available resources to meet requests for professional advice about the educational difficulties of individual children in the school situation. Present services may, in future, have to work in a different way with their specialists, giving support to teachers in their daily contacts with children who need help rather than taking on increasing commitments to treat individuals. It was suggested that a brief written statement on the relative roles of the school and of supporting services, together with guidance for the class teacher, would be of great benefit to all concerned.

The usual picture presented during this series of visits to schools was of a lack of continuity. Individual teachers and schools were making considerable efforts to help children but these activities were not co-ordinated from year to year in a school and, with a few notable exceptions, there was little carry over of information or successful methods from one phase of education to another.

It must be stressed again that this enquiry was universally welcomed; all concerned went to considerable lengths to provide information and to discuss their views. Schools were more than willing to tackle their own problems, and showed enormous tolerance for the individual. Almost all were striving to create favourable climates in which children could grow. These comments do less than justice to the efforts made. It is the scale of these efforts in general and the number of children involved which justify the need for improved support and guidance for both teachers and taught, and underline this case for increased attention to continuity of care and co-ordination of action.

The following comments were supplied by an educational psychologist working in another area.

This report brings to light a possible waste of remedial resources and the need for a recognised procedure to be established through which the efforts of teachers, parents and outside agencies could be better co-ordinated. In this way some of the doubts and difficulties felt by head-teachers and class teachers over their contacts with the specialist services might be removed.

Physical disabilities, such as those of vision, hearing and general health are normally referred to the school medical officer and the children are seen either at a routine medical examination or by special appointment. For these examinations the parents are always notified.

For children with problems such as failure to make progress, solitariness, aggressiveness, unhappiness and for those with speech difficulties or manual inco-ordination the first approach is generally to the educational psychologist.

It is not always known that the educational psychologist works for two distinct services. The school psychological service involves only the schools and the psychologist. Schools may freely contact the psychologist and ask for a visit. When the children are seen within this service there is no obligation for the parents to be notified. Sometimes it is advisable, but sometimes to avoid arousing anxiety, it may be better to contact the parents after the interview rather than before. Contact is made with the psychologist either informally by telephone or by letter, or through the local education office. Head teachers may hesitate to contact the educational psychologist for a number of reasons of which two are fairly widespread. The heads may consider that the situation could get 'out of hand' and that what is perhaps a manageable problem might escalate into something unnecessarily complicated. They may also think that a situation which is causing anxiety within the school may be considered as unimportant by someone outside the picture.

The child guidance service is the second service for which the educational psychologist works, as part of a team. Children are referred to the child guidance clinic by a large number of agents, including family doctors, hospitals, the Courts, parents and the schools. The clinic is under the direction of the consultant psychiatrist. The educational psychologist often acts as liaison between the clinic and the schools. Both the child guidance service and the school psychological service are in constant touch with the local education office and with the school medical office and records are exchanged.

After the referral of a child by the school to the educational psychologist, the first step is one of investigation and an attempt is made to discover what factors are contributing to the child's difficulties. The psychologist will normally see the child for a test or for a number of tests and will obtain the views of the head-teacher and of the class teacher. In many cases, an interview with one or both parents will throw considerable light on the situation. Sometimes the head-teacher may already have seen the parents but a second interview with possibly the psychologist and the class teacher present can be fruitful. It may happen that the head-teacher and the class teacher are not available and that the parents are seen by the psychologist alone, either in the school or elsewhere. These interviews may be of value in themselves. During the discussion, suggestions may come from any one of the participants and some picture of the child, his family and his behaviour in school will begin to emerge and, with it, possibly the cause of his difficulties. Further talks with teachers or parents may follow and, finally, recommendations are made.

These recommendations are of a widely varying kind. It may be that the main source of difficulty is in the home and that the best way of helping the child is through some modification of parental attitudes. Direct advice to parents is less useful than a gradual examination of the problem during which greater insight can be obtained. Here the 'shape' of the family and number of older and younger children is relevant, as it may have determined the role that the child who is in difficulties has had to fill. Alternatively, the problem may arise from the child's relationships in school, either with adults or with other children. Here discussion with the class teacher and adjustments in the child's school life may be indicated. There may be specific teaching problems. The child may have the type of ability or disability that lends

itself to one kind of approach rather than to another. There may be a discrepancy between what the parents are trying to do at home and what is actually being done in school. The child may have a worse or a better potential than is thought to be the case. Sometimes there are indications that the child's educational environment should be modified. There can be a change of class, or a change of school, or help in a remedial group, or in an opportunity centre, or in a residential school. There can be referral to a child guidance clinic or for a medical examination. From the point of view of the educational psychologist the child is his client. The psychologist is concerned not with diagnostic labels but with a search for the causes of the child's difficulties and with the attempt to modify them.

The report emphasises the problem of failure in communication between the various agencies and the schools. Complaints are received from head-teachers that, after the initial referral, nothing more is heard about the child. These complaints are often justified. Within the school psychological service, when the child is referred directly by the head-teacher to the psychologist, a letter or report is normally sent to the school with the diagnostic findings and the general recommendations of the psychologist.

Beyond this point difficulties do arise. A distinction should be made between what happens *about* the child and what happens *to* the child. Schools should be notified of regular clinic appointments and there should, of course, be full discussion when a change of school is proposed. It is however, difficult for clinics to report back on 'progress.' The efforts made by the clinic may not bear fruit for weeks, months or even until long after the treatment has ceased. All that can be said is that the clinic staff is doing all that it can.

Head teachers and class teachers also made the point that they receive very little direct guidance from the clinic about the handling of the child in school. This is a difficult problem as the staff of the clinic may not be fully aware of the exact conditions in each school. However, if the head-teacher should feel the need for discussion on this point, he could telephone the educational psychologist involved. In some clinics any member of the team who has had contact with the family would be prepared to receive a call of this kind.

There are also problems associated with school records and continuity. As is mentioned in the report, a number of schools, particularly infant schools, keep a detailed report on every child. Within any individual school discussion also takes place informally between members of staff. The greater difficulties arise when a child moves from infant to junior or from junior to secondary school. Sometimes the educational psychologist's report is sent with the school record card but sometimes the head-teacher concerned feels either that the report is too confidential or that it would be better for the child to have a 'completely fresh start.'

This problem has still to be solved and would be suitable for discussion between the head teachers and the educational psychologists of any given area. As the report suggests, a statement by the local authority together with guidance for the individual teacher is of great importance in defining the respective roles of the school and the supporting services and in obtaining the best co-ordination of their efforts on the child's behalf.

As described in Trends No 5, *a survey of drama in education was carried out by HM Inspectors and a report was published in January 1968. Professor Wickham contributes a review article.*

Drama in the Classroom

GLYNNE WICKHAM

Those who read *Drama** may find the factual information provided disappointingly incomplete, the conclusions reached frustratingly tentative or the relationships outlined between theatre and classroom frighteningly elusive; but, if they do, they should recall that the authors describe the book as a survey, and that the table of contents offers a comprehensive description of what, for better or worse, is actually happening now in every kind of educational establishment in England in the name of drama. Thus, if the report appears tentative and elusive in its findings, this may well reflect an actual state of affairs in schools, training colleges, youth centres and universities and suggest in consequence that the authors should be commended for refraining from imposing upon their findings degrees of definition and direction which stem from idealism rather than the truth as they found it.

In fact this survey is refreshingly honest, disturbing though this may be to administrators in the corridors of educational power or in the green rooms of professional theatres.

> 'Some heads timetable two or three drama periods a week for their least able children not because drama may help their difficulties but because it is all they are thought to be capable of.' *p. 21*
> 'Not only do [pupils] learn nothing from drama but they are encouraged in a frivolous attitude to school that increases the difficulties of teaching them the basic skills and disciplines.' *p. 19*
> 'Teachers often find that it is not easy to control thirty or forty high-spirited young people in a large space. They are naturally concerned to 'keep order.' So they tell the children what to do. They impose the image.' *p. 37*

The images recorded by the authors are often comic. One such is provided by a school in the Midlands where a group of infants was at work on a version of Red Riding Hood.

> 'There was a dance of the forest flowers and a chorus of singing woodcutters. Some of the boys had to be trees but they only stuck out their arms like scarecrows. (It is much harder, and far less satisfying, to be a tree than an animal).' *p. 10*

This description recalls all too vividly Miss Joyce Grenfell's vision of 'music and movement' with the unforgettably disruptive Sidney constantly dragging his teacher's imaginative sallies down to an earth-bound grave on the classroom floor.

*Education Survey No. 2. *Drama*, (HMSO, 1968) 9s. 6d.

These quotations give some indication of the problems that arise when drama as a classroom activity or dramatic illustration of more normal school subjects is let loose upon unsuspecting pupils and in the hands of teachers whose qualifications do not stretch far beyond faith and enthusiasm. In moving from a discussion of drama in primary and secondary schools to specific aspects of school drama—improvisation, speech, syllabus, the school play—the difficulties and disagreements revealed by the survey do not decrease: indeed they extend beyond school into youth clubs where experienced producers are scarce (pp. 64-73), into teacher training colleges where the frontiers dividing English or history from the study of drama are ambiguous (pp. 65-90) and even into the relatively new relationships presently being established between theatres and schools (pp. 91-105).

To cynical professional actors and theatre managers, and to strict disciplinarians in academic circles who have habitually regarded classroom concern with drama as at best an amateurish kind of therapy for society's misfits, and at worst as an excuse to luxuriate in a form of emotional self-indulgence that undermines the will to work and to conform, such evidence of stress and strain will come as welcome confirmation of their predictions. What they will not find to their liking in this survey, however, is the evidence (just as objectively reflected and carefully documented) of the successes which those who have advocated giving drama a place in education can now claim.

> 'The educational value of drama, particularly in a primary school, lies in the fact that a number of expressive forms are, or can be, embedded in a single dramatic action. Drama can be an educational treasure-trove from which we are often hesitant to enrich ourselves.' *p. 16*
>
> 'Drama provides opportunities . . . for the expression of many different kinds of non-verbal intelligence.' *p.20*

Evidence relating to older children is, potentially, just as encouraging.

> 'In recent years the choice of play has become very much more enterprising than formerly.' *p. 56*
>
> 'Many companies have gone far to reduce their approach to drama to proportions that make sense in a school hall without in any way lowering their standards.' *p. 98*

The survey regards the universities as outside its terms of reference, so it is worth adding that when drama was first admitted to a modest place in the general honours degree course at Bristol University in 1947, six students applied to read it: twenty years later the ratio of applications to places available in the same university for drama as a special honours degree subject was 65:1.

This fact indicates better than any other, both the context and the spirit in which this survey ought to be received; for it pinpoints the relationship of a time-factor to both the quantity and the quality of the work described by its authors. Before the war, if drama had penetrated formal education at all, it was normally only in terms of improvisation work in primary schools and 'the school-play' elsewhere. Nowhere did plays other than Shakespeare's figure in national examination syllabuses, nor was it normal to find a question on plays or the theatre in any general paper set by universities for scholarship or simple admission purposes. Today, interviewing committees at universities can expect candidates both to have seen and read plays by authors ancient and modern, while in the schools themselves most heads are

allocating significant proportions of their budgets to providing adequate space, staff and funds for the encouragement of an informed interest in many aspects of drama.

There is thus incontestable evidence of a remarkable change in the quantity of dramatic activity permitted and fostered throughout the age-range of education. It is perhaps unreasonable, therefore, to expect uniformity or agreement to exist about the quality or the value of all aspects of this work when so much of it is still experimental and when so few of those who have grown up within this environment have yet had time to assess its relevance to their own personal development and subsequent careers. Nevertheless, the inevitable consequence to this state of affairs, as the authors themselves recognise in introducing the survey, is quite clear.

> 'The need for classification is strong and, since quantity of work is far outstripping quality, urgent.' *p. 3*

Two questions arise which in themselves seem to point in the direction of the action that is required in the next two decades. How is drama to be identified and defined as a subject for teaching purposes? Who is to teach it?

The most dangerous answer to both questions is, unfortunately, also the most obvious: that drama should be defined as a subject in schools by those who teach it there, and that those who teach it should be men and women who would have liked to make a professional career in the theatre but who, for one reason or another, have already failed in this ambition. Where this happens, and it is by no means infrequent, the teacher will tend to define the subject in terms of those same untutored enthusiasms which caused him to fail to find the footing he had wanted in the professional theatre. Nowhere is this danger more evident than in the emphasis placed in some quarters upon improvisation to the virtual exclusion of the literary text. As the survey puts it,

> 'One of the problems facing school drama is that the present emphasis on improvisation is leading to an impoverishment of the literary side of drama and a disregard for dramatic literature.' *p. 25*

The crux of the matter here is to determine whether the school's objective is to provide an opportunity for certain kinds of personal development or to encourage an awareness of and interest in drama as an aspect of our cultural heritage. The answer may well be both, but this does not militate against differences of balance between one age group and another. If the case for concentrating upon improvisation among the lower age groups is a strong one, that for a shift of emphasis towards a critical approach to theatre arts and dramatic literature past and present in later schooling is just as strong. If this is not admitted by teachers of drama at secondary school level, they have no cause to complain that drama is only accorded the status of a recreational activity along with hockey and gymnastics. In other words, teachers of history, English, foreign languages or art *with qualifications in drama* can and should have as important a contribution to make to the study of drama in secondary schools as specialists in movement, mime, improvisation or elocution. And if what tends at present to be an internecine war between these categories of teacher for control of drama is to cease, the colleges of education and the universities must learn to give more serious attention to equipping both with the will and knowledge to collaborate harmoniously.

This raises the question of how the universities and colleges of education in their turn are to acquire the necessary skills and disciplines to serve as credible mentors in this capacity. There is a real danger here that the status accompanying conferment of degrees—most especially the new B.Ed.—can serve as a cloak to disguise from public scrutiny amateurish pretensions that regular exposure to audiences in a professional theatre would quickly reveal. Ample evidence of the calamitous effects that this can have both on the teaching of drama, and on professional standards of performance, is already available from America and this is a lesson which no-one should ignore. If this trend is to be avoided in England it is essential that both the universities and the colleges of education should forge the closest possible links that local circumstances allow with professional theatre companies and schools in their areas.

It is encouraging therefore that the authors of this survey should have devoted so much space and attention under the heading of 'Theatre for Children and Children's Theatre' to the most recent experiments conducted by our leading theatre companies in tackling this problem. If the survey is perhaps more sceptical and astringent in its criticism of the results achieved to date on this front than on any other, it should be remembered that the companies in question have not only taken this initiative themselves. In some instances it was they who persuaded the local education authorities to allow these experiments and not the other way round. The wonder is—at least to anyone familiar with the working conditions that confront provincial repertory companies today—that such enterprises have been pioneered at all.

It would be tragic if these efforts were to prove abortive for lack of money or encouragement: for here, if anywhere, in these direct contacts between the theatre and schools, lies the embryo of a solution to the twin problems of how drama should be treated as a subject and of how to train teachers to handle it proficiently. It is not the solution in itself. Rather is it only the start of a dialogue between the individuals most directly concerned—actors and young people, teachers, directors and managers; but that is the first step to replacement of distrust and suspicion, bred of ignorance or misunderstanding, by trust and confidence. Once the schools and the professional theatre in a given area can by these means extend their respective horizons to take account of problems and viewpoints other than their own, areas where common interests and general agreement exist will begin to become apparent and to be distinguishable from those where they do not. And once this has happened, the colleges of education and universities will possess a much firmer basis than their present uninformed and hypothetical approach allows for framing courses that will equip teachers to serve as intermediaries between young people and the art of drama.

Drama as therapy, drama as history, drama as literature, drama as recreation or drama as physical education are all useful and interesting by-products of the subject; but if drama is not recognised as first and last an art-form and taught in that context, all the efforts which have been made and are being made to re-establish it as a subject within the whole age-group spectrum of education today as revealed in this survey will degenerate into a posse of rival factions destined, in their determination to outbid each other, to effect the total dismissal of drama from all classrooms for years to come.

In Response To . . .

Finding the Time

Mr A. P. Sanday, Inspector of Schools for Warwickshire writes:

One cannot but agree with Mr Gooch that the issues raised in his article 'Finding the Time' (Trends No. 6) deserve to be fully and widely ventilated.

I think that his 'interim conclusions' are a very fair statement of the present position in schools, but I am sure that the time has come to challenge the entrenched position of the 'option system' in the fourth and fifth form.

When the SMA (as it was then) published its policy statement *Science and Education* in 1961, there were strong arguments for a common curriculum up to the age of sixteen, but those arguments must be felt to be even stronger now. Besides (as has frequently been remarked) putting the destiny of the nation in the hands of thirteen year-old schoolboys who have not been consciously prepared to make the decisions, the system doesn't even prepare them properly for the careers which they appear to have chosen. The scientist will often transfer to management in his thirties and will have to draw on ideas from the social sciences and the humanities, and a graduate in history may equally well enter commerce or the management side of a technological industry.

It might be asked, with some justification, whether anything done at school between the ages of thirteen and sixteen will have any effect on a man in his thirties, and the reply would have to be that in order to be effective, an element of general education would have to accompany any specialist further education. But this element of general education will be much better based if the common curriculum has been continued to that age when the pupil is able to handle abstract ideas with some competency. This, I think, is the important point. To put it rather crudely, what hope is there of forming a framework of abstract concepts which future ideas can latch on to if we discontinue education in that field before the age when abstract ideas are handled with any facility?

If then we grant the case for a common curriculum up to the age of sixteen, we must re-examine the vexed question of period allocation. Religious education by law claims one period, and a minimum allocation to PE and games would be three periods. It is generally conceded that English, mathematics and a foreign language require one period per day each (at least in the early years), and there is a strong case for adding one form period and an afternoon (three periods) for creative subjects (art, craft, music, drama, applied science projects etc.)

On a thirty-five period week, this leaves twelve periods for the other claims on the curriculum, which are the sciences, the humanities and the social sciences (c.f. *The Curriculum*, School Council Working Paper No. 12). A rough and ready division gives six periods to the sciences and six periods to the humanities and the social sciences.

The critical question is now: 'Can the reasonable objectives within each subject area be achieved within this limited period allocation?'

Defining 'reasonable objectives' is very difficult, but it might be agreed that these would include a knowledge of (1) those facts, skills or activities which are so relevant that they will be in general use or can be encountered frequently once an awareness has been aroused. (2) the way in which information is acquired in that subject area and the criteria for its validity. (3) the outline of the large conceptual structures—the details are rapidly forgotten, but a framework is left for ideas which are acquired later to latch on to. So if we ask the question with respect to science, we shall want to know whether a course can be devised which achieves these objectives on six periods per week for five years, with proper regard to the pupils' capabilities. The answer might well be that it cannot: that at the end of five years a pupil would have conceptual structures which are so incomplete that they would be virtually worthless as a basis for future development at a later stage of his career.

Let us examine the question in more detail as it applies to science, although similar reasoning will apply to the other domains.

A superficial answer might be: 'Yes, there is such a course—general science.' However, a more careful examination shows that the traditional O-level general science course does not achieve the objectives which I have specified. Much of the subject matter is not relevant to the lives which many of our pupils will lead; the way in which scientists acquire information receives scant attention, and most important in my opinion, it does not have a unified conceptual structure. There is no proper basis of integration, and it consists of the three sciences each dealt with inadequately.

If we pursue this matter of a unified conceptual structure, we see that the subject falls apart into at least two structures, biological sciences and physical sciences. It might be possible to have a biological sciences course on two periods per week for five years, and the remaining question is then 'Can there be a sensibly integrated physical sciences course on four periods per week, or viable separate courses in physics and chemistry on two periods per week?'

Personally, I do not know the answer to this question. To the best of my knowledge, a physical sciences course has not yet been devised, although it might be possible to devise such a course from the Nuffield materials. The question deserves a detailed treatment by those properly qualified to do so. But it is on the answer to this question, and the answers to similar questions about other domains of knowledge, that the possibility of having a general five-year course depends.

We can see then that it might be possible to develop a general five year course with roughly the period allocations as in Table I.

There would be parallel GCE, CSE and non-examination courses in each subject, which would differ principally in the balance of 'immediate relevance' and 'abstract concepts.' Pupils who could handle abstract concepts in one subject area but not in another would be able to do some GCE subjects and some CSE subjects, and the early years of the secondary schools would be devoted to finding out the facility with which each pupil could handle abstract ideas in each subject area.

Table I	Yrs 1 and 2	Yrs 3, 4 and 5
PE and games	3	3
RE	1	1
Mathematics	5	4
English	5	4
Modern language	5	4
Second modern language (or European studies?)		3
Creative subjects	3	3
Science	6	6
Humanities and Social Sciences	6	6
Form/house period	1	1
	35	35

A. G. Gooch writes:

It is unwise to condemn all systems of options because some are educationally unsound. A pupil who has had a three-year course in art, music and handicrafts but can only afford a comparatively small time allocation for creative subjects in the two final years, will generally be better served by an opportunity to concentrate on one of these subjects rather than to continue all in a very superficial manner. On the other hand, options of the 'exclusive alternative' type, as when the pupil must opt for chemistry or art, history or geography, and cannot possibly continue both subjects of a pair, really have no educational justification.

An 11-16 common course for all levels of ability has many disadvantages. There is only space in this brief note to mention one of these which would result from the application of Mr Sanday's time analysis. Whilst the association of an allowance of only three periods weekly for the potentially enormous field of creative subjects, with five and seven periods at successive stages for modern language studies, would be acceptable to some teachers if applied only to pupils of very high ability, it would, I believe, gain practically no

support as a programme for the pupil of average, or less than average, ability.

What is needed, I suggest, is a reasoned combination of 'breadth' with 'depth.' 'Breadth' which avoids the exclusion of any major field of study from a pre-16 secondary course for any individual, and 'depth' which ensures that what is studied is dealt with in an exacting manner in relation to the ability level of the child under consideration.

Student Attitudes

Mr. H. Frost of the University of London Department of Extra-Mural Studies carried out a survey of student views of the status of the technologist. The following is an abridged version of his report.

First and second year technology students were asked their views on the roles of science and technology in society, their reasons for choosing these fields, and about the nature (methodology) of these and other subjects.

Earlier studies had suggested that problems of career-choice and rejection of the sciences, since considered in the Dainton Report, reflect the teaching of obsolete *attitudes* to science and technology as much as, or more than, obsolete *content*, and an opportunity was taken to study attitudes in young people not more than one year away from school science.

As a prelude to their liberal studies, a set of questions was put to them 'to set them thinking'.

They were first asked to write a few lines about science, technology, mathematics, philosophy, history, religion and art so as to bring out important differences between them as ways of dealing with some of life's problems.

This question was asked specifically to ascertain whether there was any appreciation of what philosophers call the hypothetico-deductive account of science—of science as creative activity—and whether there was any recognition of the key role in science of the mental models held by scientists. In the seventy or so papers returned there were three phrases which might have referred to mental models and one possible reference to the hypothetico-deductive view of science: none of these were certain references. There was no reference to creativity although three students mentioned that scientific activity reflects human curiosity. The largest group (68 per cent) saw science as uncovering of 'truth' or 'reality'. Ten per cent referred to 'ordered facts' but evidently equated facts with truth.

In subsequent lectures it was obvious, at the point where an account was given of science as a creative activity, that the concept was new to the students and made a deep impact. They were particularly forthcoming with questions; many were to the effect 'Why were we not told this before?'

Technology was regarded simply as 'applied science' by 91 per cent; only 13 per cent referred to its interaction with social progress and there were no references to any imaginative element in technology. There was no evidence that students had been given any picture of the nature of mathematics. Eighty-three per cent described it as a *science* standing for something absolute in the physical world; 50 per cent saw it mainly as a tool for use in the sciences.

Forty per cent thought philosophy was concerned with 'causes', 22 per cent that it dealt with social or moral problems, 20 per cent that it helped to develop judgement or provided a mental training and 15 per cent that it provided comfort.

Forty per cent of students took refuge behind statements to the effect that religion was a set of 'beliefs' without further explanation, and 55 per cent saw religion as a comfort in time of difficulty—mainly for other people. Art was regarded by 42 per cent as a form of self-expression for personal satisfaction; 35 per cent thought it was a means of communicating ideas—not always successfully.

They were next asked about choosing careers:

(a) *When young men or women of the necessary ability are deciding between scientific, commercial or literary subjects as their main fields of study,*

what are the points they might take into consideration?

(b) *If a decision has been made to study science, what points might influence the subsequent decision between pure and applied science?*

(a) The answers showed a dominant belief that a process of matching one's own characteristics, tastes, abilities and expectations to the characteristics of fields of study and related jobs, determine choice. There was a confident assumption that this process is both possible and efficient. Only one student noted the existence of more sophisticated techniques of vocational guidance. Eleven per cent appreciated that matching was between personal characteristics and the 'image' of the field study or job, but they did not appear to recognise that the concept of an 'image' may be equally applicable to personal characteristics.

This 94 per cent of 'matchers' is to be compared with only four per cent who referred to salary or prospects as primary determinants of choice, and only 43 per cent who referred to them at all.

Nine per cent referred to external pressures on choice, including: influence by family connections, advice received on choice of career, relative amounts of work involved in training (science involves prolonged toil), decision effectively taken by the school, relative costs of courses of training, where a college place can be found, etc. There were scattered references to amenities in various jobs, to types of people likely to be met, to problems of competition and security.

'Commercialism as a career requires that the applicant should be possessed of reasonable ability in the man-management field which is not generally so important in the other two fields'.

'If a person has a practical mind and is interested in problems which crop up in life, he should choose a technical subject as a career as he would soon become bored with writing'.

'If they would rather not do anything rational or study and be with people, then they should consider a career in the field of literary subjects'.

'In actual fact many pure scientists are men with above standard brain power, while engineers, although clever, are generally not as clever and I think this might be the deciding factor in the choice between pure and applied science: what brain power you have'.

There were several references to the notions that commerce requires judgement, and art requires imagination, with the implication that technology requires neither. There was also a tendency to equate commerce with 'rat-race'.

(b) Students were inclined to see the choice between pure and applied science as a choice between research and some sort of manufacture or production; nobody seemed to know that a vast amount of research is undertaken in the applied sciences.

Strangely, although the notion of creative activity never appeared in answers to the first question, there was occasional reference here to the logical thought of the pure scientist versus the creative activity of the applied scientist. The intended nature of the distinction was never clear, but apparently 'creative' was intended in the sense of constructing a tangible product rather than of creative imagination. There were few references to relative salaries but it was generally assumed that technologists would be paid more.

The students were then asked to imagine that they were responsible for setting up the Government incomes policy and award salaries in the range of £500-£5,000 a year to each of a number of professions. They were to set them out in order with the highest paid at the top. They were to give reasons for their placings.

The answers are summarised in Table 1.

The figures in the right hand column (standard deviation per cent) can be taken as a measure of the group's uncertainty about the placing of the profession concerned. It is notable that the smallest deviations are for the top profession (doctor) and the bottom (engineering draughtsman).

Half the professions show standard deviations of less than one-third; the students had a reasonably clear image of these—all

TABLE 1

	Mean Salary Awarded	*Standard Deviation*	
	£	£	*per cent*
Doctor	3750	905	24
Nuclear physicist	3475	1160	33
Agricultural scientist	3325	975	29
Civil engineer	3125	805	26
School head-teacher	2815	830	29
Lawyer	2790	950	34
Works manager	2265	930	41
National Secretary (Trade Union)	2175	1180	54
Company accountant	2080	1000	48
Farm manager	1970	690	35
School science teacher	1855	560	30
Town clerk	1850	1135	61
Orchestral musician	1380	600	43
Engineering draughtsman	1330	330	25

scientists, technologists or other professions which students have already met.

The students had less clear images about the professions with standard deviations greater than one-third. None of these is a scientist, nor with the possible exception of the works manager, a technologist, but only two (orchestral musician and town clerk) are professions which might reasonably be described as unrelated to the practice of technology.

Student views about these professions may perhaps best be illustrated by quotations: 'I list a works manager near the bottom because his academic level of education relative to the other people is not necessarily high'.

'The orchestral musician, although giving enjoyment to a limited number of the community, bears no important responsibility apart from that of keeping in tune with the rest of the orchestra'.

Several students mentioned that they would have awarded a higher salary to the orchestral musician had the question not referred to 'importance to the community'. The musician only 'gives enjoyment' and this was taken to be not important to the community.

There were wide divergencies of view about the functions of the trade union official; two students placed him at the top of the scale, giving as their reasons:

'Good labour leadership is important to the nation'.

'The trade union secretary has great responsibility for the smooth workings of the community'.

On the other hand:

'I do not think that unions in general are either good or useful things today, therefore I think that union secretaries are superfluous'.

'Although a trade union secretary may have a degree of responsibility, that is all he should be valued for and subsequently paid for. His training is usually negligible and since his value to the community is a negative quantity, I think £500 is too much. Everybody knows and realises that it is the idiotic and scandalous acts of trade unions which largely account for Great Britain's plight and it is about time something was done to stop them'.

'The town clerk and national secretary of a trade union I think should not be treated as professional posts, merely as responsible jobs'.

'The town clerk needs next to no training and has not got much responsibility. He just has to be elected'.

'The town clerk is placed halfway down

the ladder because the responsibility and training required are as for the average civil servant. Although this profession is not so important as many others, it is still a necessary post in the local government'.

'Town clerks are the people who are our local government and who see to it that rates are charged for appropriate residences and that this money is put to the best use. This is the fellow that helps govern what money we earn, how much money we give to rates, and so I have positioned him at the number one position. The nuclear physicist is placed so low because I feel that the physicist is not essential to the community as is a town clerk, doctor or a lawyer, but merely helps shape the community of the future in a round about way'.

'The company accountant requires a greater amount of training than the union official but his responsibility only goes as far as the shareholders of the company which are a very small percentage of the community and this only makes his importance relatively small'.

The students were next asked *how far a technologist should take into account social factors in his work.*

Most of the students saw projects primarily from the technological side and regarded social and labour factors as 'constraints' on the project. They were divided roughly five to four in favour of having a little knowledge of these constraints versus leaving them to somebody else, described without further definition as 'the management'. Labour in general was regarded as malevolent or stupid or both. Most students appeared to think that such understanding of labour problems as was necessary could be picked up by experience, and generally they did not distinguish labour management from 'learning to handle men'. Many students equated 'social implications' with public opinion and saw it mainly as a technological obstruction; it needed to be studied so that it could be manipulated in favour of the project, but it should certainly not be a determining factor. There appeared to be two main sub-groups, the first was in favour of taking public opinion into consideration if convenient while retaining the primacy of the project itself: some suggested that the technologist should, in his own interests, avoid being too revolutionary. The second group thought that social considerations would stop all technological advance; they should be ignored and technologists should take the plunge.

Students were also asked why, given that most scientific discoveries are made by comparatively young men, research, design and production departments are headed by older people; and whether scientists and technologists ought to be more closely involved in Government. It was overwhelmingly concluded that age confers experience and that politics would take up too much of a scientist's time. Some students thought that politics would fail to make use of a scientist's or technologist's training, and others that these disciplines demanded a type of brain unsuitable to politics.

A limited number of copies of the report from which this article is derived are available from Mr. H. Frost, University of London Department of Extra-Mural Studies (7 Ridgmount Street, London W.C.1), on receipt of a stamped, addressed foolscap envelope.

Experiment in Teaching

A new DES film.

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Enquiries should be addressed to Miss A. Edwards, Information Division, Room 115, Department of Education and Science, Curzon Street, London W.1.

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